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REPORT NO T8-89

PSYCHOLOGICAL ATTRIBUTES, COPING STRATEGIES AND OTHER FACTORS ASSOCIATED WITH ULTRAMARATHON PERFORMANCE

U S ARMY RESEARCH INSTITUTE
OF
ENVIRONMENTAL MEDICINE
Natick, Massachusetts

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UNITED STATES ARMY
MEDICAL RESEARCH & DEVELOPMENT COMMAND

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Mood states, symptomatology, coping strategies and training characteristics associated with running an ultramarathon were examined to explain racing performance and assess psychological health state. A total of 117 subjects were surveyed in 2 races (50-mile and 100-mile). Mood states and symptomatology were examined via a time-series approach with subjects queried pre, post, 1 week post, 1 month post, and 3 months postrun. Tension was found to be significantly greater prerun when compared to other administrations. Vigor was found to be significantly lower immediately postrun compared to the other administrations, whereas fatigue was found to be greater immediately postrun. Confusion was greater immediately postrun but had returned to prerace levels by 1 month postrun. Casualties were less fatigued and more depressed immediately postrun than were survivors. Additionally, survivors were found to be in better physical condition than casualties. The survivors weighed less, had been running for a longer period of time, ran more miles per week and ran at a faster training pace. Coping strategies were found to have an effect on performance.

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It appears that individuals who partition the race into segments fare better than those who do not. Finally, age, expected finish time and training pace are the best predictors for one's finish time in a 50-mile ultramarathon.

The views, opinions and/or findings contained in this report are those of the authors and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation.

Human subjects participated in this study after giving their free and informed voluntary consent. Investigators adhered to AR 70-25 and USAMRDC Regulation 70-25 on Use of Volunteers in Research.

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TECHNICAL REPORT

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PSYCHOLOGICAL ATTRIBUTES, COPING STRATEGIES AND OTHER FACTORS ASSOCIATED WITH ULTRAMARATHON PERFORMANCE

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ABSTRACT

Mood states, symptomatology, coping strategies and training characteristics associated with running an ultramarathon were examined to explain racing performance and assess psychological health state. A total of 117 subjects were surveyed in 2 races (50-mile and 100-mile). Mood states and symptomatology were examined via a time-series approach with subjects queried pre, post, 1 week post, 1 month post, and 3 months postrun. Tension was found to be significantly greater prerun when compared to other administrations. Vigor was found to be significantly lower immediately postrun compared to the other administrations, whereas fatigue was found to be greater immediately postrun. Confusion was greater immediately postrun but had returned to prerace levels by 1 month postrun. Casualties were less fatigued and more depressed immediately postrun than were survivors. Additionally, survivors were found to be in better physical condition than casualties. The survivors weighed less, had been running for a longer period of time, ran more miles per week and ran at a faster training pace. Coping strategies were found to have an effect on performance. It appears that individuals who partition the race into segments fare better than those who do not. Finally, age, expected finish time and training pace are the best predictors for one's finish time in a 50-mile ultramarathon.

INTRODUCTION

It has been realized for some time that various psychological parameters such as mood state or psychological type of the individual influence performance. The importance various psychological parameters have on ultra-endurance performance has recently been examined. Ultramarathoners (runners who compete at races longer than 26.2 miles) must endure the physical discomforts associated with running up to 30 consecutive hours. These runners have often reported numerous changes in their mood state over the course of a race. Subjective mood changes were observed via the Profile of Mood States (POMS) questionnaire (McNair, Lorr, & Droppleman, 1981) in connection with the running of an ultramarathon. These changes are characterized by increased levels of depression, fatigue, and confusion as well as a decrease in the level of tension and vigor immediately postrun as compared to prerun levels (Tharion, Strowman, & Rauch, 1988).

Joesting (1981) reported no affective changes throughout a 50-mile run via a self-administered Multiple Affect Adjective Checklist (MAACL). However, Joesting's study was a case study using the author as the only subject. Previous research has revealed changes in mood states as a function of physical exercise (Folkins, 1976; Folkins & Sime, 1981; Dishman, 1985; and Morgan, 1985). Berger and Owen (1983) reported desirable mood changes (reduced levels of tension, depression, anger and confusion with an increase in vigor) following 40-minute swim classes. Markoff, Ryan and Young (1982) found significant reductions in tension and anger levels following a run of approximately one hour duration. Berger and Owen (1981) and Markoff et al. (1982) both used the POMS with the response set of "how you are feeling right

now". Changes in mood states over the course of an ultramarathon occur over a much longer time frame and perhaps at a higher sustained work load. Some caution must be taken when comparing mood changes as a result of an ultramarathon competition with changes in mood states that have previously been reported following much shorter bouts of physical exercise. Most studies to date have assessed mood states before and after acute physical exercise of one to three hours duration or before and after chronic exercise programs lasting 6-20 weeks. Typically, improved affective states and antidepressant effects accompany both acute and chronic physical activity (Dishman, 1985). Furthermore, these studies have not been conducted under a competitive setting. It may be hypothesized that under a competitive setting there may be an elevated level of the negative mood states due to the stresses associated with competition.

Characteristics of ultramarathoners have revealed varying results. McCutcheon and Yoakum (1983) studied a group of ultramarathoners who were matched for age and sex with runners and nonrunners. All three groups were administered the Self-Motivation Inventory (SMI) and the Philosophy of Human Nature Scale. No personality differences were reported between groups with respect to either of these measures. Folkins and Wieselberg-Bell (1981) found significant differences between ultramarathoners and normal males on three factors of the MAACL with the ultramarathoners being significantly less anxious, hostile, and depressed than male college students.

Morgan and Pollock (1977) examined mood profiles of elite runners using the POMS. They found these runners reported higher subjective feelings of vigor in comparison to college norms while reporting lower than college norms

on the five negative mood scales. This particular mood profile has been termed as the "iceberg profile" by Morgan. In subsequent studies examining psychological profiles of various groups of athletes, the same iceberg profile has been observed in wrestlers (Morgan & Johnson, 1977), rowers (Morgan & Johnson, 1978), non-elite runners (Gondala and Tuckman, 1982), swimmers (Berger & Owen, 1983 and Johnson & Morgan, 1981), and ultramarathoners (Tharion et al., 1988).

Previous studies have investigated factors related to competitive running. Slovic (1977) and McKelvie, Valliant, and Asu (1985) identified factors related to marathon completition time. Slovic (1977) reported the best predictors as total training mileage, length of longest training run, and one's fastest 5 and 10-mile race times. McKelvie et al. (1985) found the following factors best predicted marathon completition time: best 10-KM time, miles per week run, previous number of marathons completed, days lost through injury or illness and a personality characteristic for regression-sensitization. Rauch, Tharion, Strowman, and Shukitt (1988) examined characteristics that helped to predict 50-mile race time. They found two variables (training pace and expected race time) were effective in predicting performance, $\underline{R}$ = .75. Parrot, Mansour and Underwood (1979) found that the two best predictors of ultramarathon finish time were one's recent best marathon time and their expected race time. Of interest here is whether these same variables predict performance for varying ultramarathon distances.

Relation of the Ultramarathon to Army Field Studies

Studies conducted with armor and artillery personnel in a simulated contaminated nuclear, biological or chemical (NBC) environment during sustained operations yielded significantly different psychological profiles for survivors (those soldiers who completed the study) and casualties (those soldiers who withdrew from the study prior to its termination) (Tharion, Rauch, Munro, Lussier, Banderet, & Shukitt, 1986; and Rauch, Banderet, Tharion, Munro, Lussier, & Shukitt, 1986). The casualties had more somatic complaints, exhibited higher levels of depression and trait anxiety, and showed lower levels of self-motivation than survivors. In a study of ultramarathon runners, Tharion, Rauch, Strowman and Shukitt (1987) found significant differences existed between survivors (those subjects who completed the ultramarathon) and casualties (those subjects who withdrew from the ultramarathon after starting). Significant differences existed between survivors and casualties for mean body weight, predicted race time, and average training pace. There were no differences in mood state reported between groups (survivor vs. casualty) prior to the race. Additionally, no differences in self-motivation using the SMI (Dishman, Ickles, & Morgan, 1980), existed between groups. However, postrun survivors were found to exhibit significantly more symptoms, greater symptom intensities, and a greater level of fatigue as reported on the POMS than casualties (Tharion et al., 1987).

The apparent inconsistency in these findings when compared to the simulated NBC sustained operation studies may be attributed to differences in motivation level and one's commitment to the activity under study. In the NBC

studies, casualties showed lower self-motivation levels than survivors (Casualty's $\underline{M}$ = 23.96 vs. Survivor's $\underline{M}$ = 33.36; these values reflect motivation in terms of days one could be expected to adhere to an exercise program based on the formula developed by Dishman et al. (1980)) (Tharion et al., 1986). Furthermore, one may question the volunteer status of some soldiers. Although the soldier had a choice whether or not to participate, if he chose not to participate he may have been assigned training which was either less desirable or which would not be as advantageous to the soldier's military career. On the other hand, all subjects in the ultramarathon study were selected from a pool of entrants who had already registered for the race. These runners were highly motivated to achieve the task at hand. They scored high on a different measure of self-motivation with a mean of 160.56. This level of motivation is considerably higher than that reported in college norms; $\underline{M}$ = 140.50 (Dishman et al., 1980), armor personnel; $\underline{M}$ = 150.16* (Tharion, et al., 1986), or artillery personnel; $\underline{M}$ = 143.32 (Knapik, Patton, Ginsburg, Redmond, Rose, Tharion, Vogel & Drews, 1987).

Finally, a comparison of motivation scores of the different personnel show that the ultramarathoners are a much more homogenous group. Within the soldier sample there were some very motivated individuals and some that were not, as assessed by the SMI. Because the ultramarathoners chose voluntarily to

* The motivation score was reported as 29.53 for the armor personnel. This score takes into account body weight and % body fat as well as the self-motivation value to represent the number of days an individual could be expected to adhere to an exercise program.

participate in the event without the knowledge that a study was being conducted, their source of motivation to achieve was more likely to be intrinsic in nature. Failure to achieve the goal of finishing was probably more a function of improper conditioning and/or lack of training.

Because the casualties did not run as far or for as long as the survivors they were less symptomatic and experienced less fatigue postrun. The soldiers who became casualties probably, in general, had a motivation to achieve which was based extrinsically. Failure to achieve the set objective, which was determined by the research team rather than the individual soldier probably influenced the soldier's perceptions of discomfort when terminating from the scenario. Hence, cognitive dissonance is reduced by reporting both a high number of and a high intensity of symptomatic complaints. It is not being suggested that these soldiers did not feel bad, they did; only that one's perception of complaints is probably heightened when there is a failure to achieve an objective which was set extrinsically. Therefore, one's symptomatology is probably measuring slightly different aspects in the two studies. In the ultramarathon study, reported symptoms may have been based more on the physical and mental demands of the race, whereas in the NBC studies symptomatology may have been a measure of how soldiers think they should feel given their particular outcome. The ultramarathoners had no reason to justify how they felt; however because the soldier felt he was expected to endure for a given period of time, their reported feelings may serve as a justification for their performance.

Relevance to the U.S. Army

The ultramarathon is an excellent source of information on psychological and physiological factors that limit human performance for a number of reasons. An advantage to the U.S. Army of studying the ultramarathon is that it provides a cost effective parallel to sustained military operations. Data from past ultramarathons (Demoney, 1986) has demonstrated there is a much higher percentage of dropouts than in shorter footraces. With a high percentage of dropouts one may examine statistically the differences that exist between successful and unsuccessful performance. Additionally, the time required, 6.5 to 24 hours to complete the ultramarathon, is similar to that required in many sustained military operations. There are a number of stressors in the ultramarathon both physical and psychological which parallel those associated with military operations. Furthermore, the quantitative measurements that may be obtained such as distances travelled and time elapsed in the race lend themselves well to field research.

Often in field studies there is a lack of quantitative measurement, especially in terms of how well the individual is performing. The information obtained via the ultramarathon provides valuable supplemental information on the psychological attributes associated with physical exertion over an extended period of time. The high motivation levels of the ultramarathoners should allow for the differences in other psychological and physiological measurements to be more apparent.

There were several objectives in this study. They were:

1.) To investigate an ultra-endurance event, in this case an ultramarathon, and determine the training and psychological variables that influence performance.

2.) To assess coping strategies employed by endurance athletes in an ultramarathon. In addition, are there differences in those strategies used by successful ultramarathoners as opposed to unsuccessful ultramarathoners?

3.) To assess the length of time mood changes associated with running an ultramarathon take to return to prerun levels.

4.) To further refine the regression equation to predict finishing time based on psychological and demographic data.

5.) To obtain changes in activity level associated with possible diurnal effects as well as subjective feelings associated with the running of the race.

METHODOLOGY

Subjects

Subjects were 45 registered entrants of the Massanutten Mountain Massacre 50-Mile Trail Run and 83 registered entrants of the Old Dominion 100-Mile Endurance Run, (both races taking place in Front Royal, VA), who volunteered to participate in the study. Of the 128 total subjects 117 were male and 11 were female. All subjects were asked to read and sign a volunteer agreement of informed consent.

Apparatus

A psychological assessment battery was administered twelve hours pre, immediately post, one week post, one month post and three months postrun. The battery consisted of a Demographics Questionnaire, an Environmental Symptoms Questionnaire (ESQ), Profile of Mood States (POMS), and a Runner's Coping Strategies Questionnaire (RCSQ). In addition, one runner as well as one non-runner were measured using an activity monitor to record level of physical activity throughout the course of the race.

The Demographics Questionnaire was administered to ascertain basic demographic variables such as height, weight, age, and background running and training information. The ESQ consists of a 41 item inventory of symptom states and was administered to assess psychological perceptions of physiologically based symptoms experienced over the five test administrations. The POMS consists of 65 adjectives administered to assess mood state changes over the five test administrations. The RCSQ is a 29 item questionnaire developed for this study, which examines the self-reported use and subjective feelings of strategies which were thought to help performance in the ultramarathon.

The strategies were either ones used in preparation for the event, or strategies used during the event itself. The strategies and practices included in the questionnaire were drawn from several sources. One primary source was a preliminary set of studies conducted on armor and infantry units in a simulated NBC environment (Munro, Rauch, Banderet, Lussier, Tharion & Shukitt, 1987 and Posen, Munro, Mitchell & Satterthwaite, 1985). In these NBC studies a program was conducted where soldiers were trained in relaxation and other stress

management procedures. The soldiers then participated in a sustained military operation scenario. After this scenario, they were asked which coping strategies they felt were helpful in their completion of the operation. Some of the strategies for this questionnaire were developed from direct interviews with these soldiers and from the initial coping strategies developed by Munro et al. (1987).

Another primary source of coping strategies was the sport psychology literature. Morgan found that elite distance runners tend to use associative techniques (strategies related to monitoring body sensations) to cope with the demands of distance running as opposed to non-elite distance runners who utilized dissociative techniques (strategies designed to ignore painful body sensations) (Morgan and Pollock, 1977). More recently others have found that factors such as distance run and type of run may have significant confounding effects on the type of coping strategies employed (McCutcheon, 1983 and Sacks et al., 1981). Other sources of strategies included in the questionnaire are those that have been reported in use by athletes in the popular and scientific literature (Klavora, 1979; Kroll, 1982; Morgan, Horstman, Cymerman & Stokes, 1983 and Nideffer, 1985).

The RCSQ strategies were divided into five categories: (1) eleven strategies concerned primarily with psychological processes (e.g. used positive mental imagery), (2) eight training or event strategies (e.g. tapered for this race), (3) two dietary practices (e.g. did carbohydrate loading), (4) three social interactions (e.g. purposely ran with others), and (5) five physiological/body processes (e.g. focused on body functions such as heart rate, breathing, etc.). Subjects were asked to check a particular strategy if

they used it. Subjects were also asked if each of the strategies they used was perceived to be helpful in running the race.

The activity monitors employed (actigraphs) were compact (2.5" x 3.5" x 3/4"), light-weight (3 oz.), microprocessor-based units. The units consist of a two-element piezoelectric crystal, sensitive to 0.01 g of force in all three planes of motion in the detection of motor activity. The monitors were initialized to record motor activity in 1 minute intervals (epochs). Each individual epoch is stored in a unique memory location and retrieval is accomplished using a custom interface and an IBM compatible personal computer. From the minute-by-minute records of motor activity collected by the actigraph, it is possible to identify periods of sleep, rest, and high physical activity. During sleep, only a few counts are recorded per hour while extensive physical activity produces levels as high as 300 counts per minute (Askew, E. W., Munro, I., Sharp, M.A., Siegal, S., et al. 1987).

Procedure

All registered runners taking part in the two ultramarathons were approached and asked to participate in the study. If they chose to participate, they were asked to read and sign a volunteer agreement of informed consent. They were also asked to complete the psychological assessment battery. Of the 212 registered runners, 128 volunteered to participate as subjects and had useable data. However, not all subjects completed all portions of the assessment. Subjects were requested to complete the prerun portion of the battery (Demographics, POMS, and ESQ) twelve hours prior to the start of the run. In addition, subjects were informed that they would be

requested to complete the POMS, ESQ, and RCSQ questionnaires upon terminating the run. During the run, data collectors waited for subjects to reach various checkpoints and administered postrun questionnaires to any subject that withdrew or was removed from the race. After the race subjects were given POMS and ESQ questionnaires and stamped envelopes addressed to USARIEM to return upon completion at 1 week, 1 month, and 3 month intervals.

One subject was monitored for physical activity using an activity monitor developed at the Walter Reed Army Institute of Research (Redmond & Hegge, 1985). The monitor was attached to the non-dominant limb at the wrist at 1800 hours the day prior to the race. This subject was competing in the 100-mile race. The monitor remained on the subject throughout the race and for about 11 hours of recovery following the race. Another individual, a non-runner who was a data collector at the finish line, served as a control.

RESULTS

Demographic information for both phases (50-mile and 100-mile) of the ultramarathon may be found in Tables 1 and 2 respectively. Tables 3-6 represent the demographic characteristics of male and female subjects by race. Not all subjects answered all questions. The differences in the number of subjects in the tables reflect this limitation of the study.

Subjects were divided into two groups post hoc. Survivors were subjects who completed the race. Casualties were subjects who either voluntarily withdrew or were administratively or medically removed from the race for safety reasons.

TABLE 1

Means, Standard Deviations and Ranges of Demographic Characteristics (50-Mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (yrs.)	45	39.42	7.20	22.00 - 55.00
Height (inches)	45	69.80	3.18	60.00 - 75.00
Weight (lbs.)	45	162.69	17.31	114.00 - 195.00
% Body fat	19	10.5	2.91	5.50 - 16.00
Years Running Competitively	44	7.97	3.71	0.00 - 20.00
Longest Race Run (miles)	45	68.00	38.69	6.00 - 217.00
Expected Race Time (hrs:mins)	45	11:10	1:06	8:54 - 13:00
Weeks Trained for Race	42	18.67	17.00	0.00 - 52.00
Miles/Week Trained	45	53.33	20.50	10.00 - 110.00
Longest Training Run	45	24.71	8.11	9.00 - 50.00
Avg. Training Pace (min:sec/mile)	45	7:56	:49	6:45 - 10:00

TABLE 2

Means, Standard Deviations and Ranges of Demographic Characteristics (100-Mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (yrs.)	83	40.12	7.76	22.00 - 58.00
Height (inches)	82	69.27	3.47	58.00 - 76.00
Weight (lbs.)	80	153.86	20.79	98.00 - 190.00
% Body fat	42	13.55	5.58	4.00 - 26.00
Years Running Competitively	83	9.47	4.17	1.00 - 25.00
Longest Race Run (miles)	83	90.42	40.47	25.00 - 265.00
Expected Race Time (hrs:mins)	81	23:47	2:28	19:00 - 30:00
Weeks Trained for Race	81	22.35	15.79	0.00 - 52.00
Miles/Week Trained	83	62.01	20.51	27.00 - 150.00
Longest Training Run	82	36.26	12.15	12.00 - 80.00
Avg. Training Pace	83	8:14	1:04	6:18 - 12:00
10 KM Time (min:sec)	68	38:23	3:45	32:00 - 49:00
Marathon Time (hours:min)	77	3:07	:22	2:34 - 4:40

TABLE 3

Means, Standard Deviations and Ranges of Demographic Characteristics of Males (50-Mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (years)	43	39.72	7.22	22.00 - 55.00
Height (inches)	43	70.12	2.88	60.00 - 75.00
Weight (lbs.)	43	164.70	14.82	140.00 - 195.00
% Body Fat	18	10.22	2.67	5.50 - 14.00
Years Running Competitively	43	7.97	3.76	0.00 - 20.00
Longest Race Run (miles)	43	69.39	38.94	6.00 - 217.00
Expected Race Time (hrs:mins)	43	11:07	1:05	8:54 - 13:00
Weeks Trained for Race	40	19.00	17.36	0.00 - 52.00
Miles/Week Trained	43	53.49	20.71	10.00 - 110.00
Longest Training Run	43	24.84	8.10	9.00 - 50.00
Avg. Training Pace	43	7:56	:48	6:45 - 10:00

TABLE 4

Means, Standard Deviations and Ranges of Demographic Characteristics of Males (100-Mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (years)	70	40.28	8.13	22.00 - 58.00
Height (inches)	73	69.82	3.20	58.00 - 76.00
Weight (lbs.)	71	158.23	17.62	98.00 - 190.00
% Body Fat	38	12.92	5.20	4.00 - 24.00
Years Running Competitively	74	9.68	4.32	1.00 - 25.00
Longest Race Run (miles)	74	91.54	42.21	25.00 - 265.00
Expected Race Time (hrs:mins)	72	23:46	2:28	19:00 - 30:00
Weeks Trained for Race	72	21.88	15.89	0.00 - 52.00
Miles/Week Trained	74	66.68	20.64	27.00 - 150.00
Longest Training Run	73	35.74	12.32	9.00 - 50.00
Avg. Training Pace (min:sec/mile)	74	8:07	1:02	6:05 - 12:00
10 KM Time (mins:secs)	61	37:48	3:25	32:00 - 49:00
Marathon Time (hrs:mins)	68	3:02	:22	2:34 - 3:55

TABLE 5

Means, Standard Deviations and Ranges of Demographic Characteristics of Females (50-mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (years)	2	33.00	2.83	31.00 - 35.00
Height (inches)	2	63.00	0.00	63.00 - 63.00
Weight (lbs.)	2	119.50	7.78	114.00 - 125.00
% Body Fat	1	16.00	0.00	16.00 - 16.00
Years Running Competitively	1	8.00	0.00	8.00 - 8.00
Longest Race Run (miles)	2	38.00	16.97	26.00 - 50.00
Predicted Race Time (hrs:mins)	2	12:23	0:32	12:00 - 12:45
Weeks Trained for Race	2	12.00	2.83	10.00 - 14.00
Miles/Week Trained	2	50.00	21.21	35.00 - 65.00
Longest Training Run	2	22.00	11.31	14.00 - 30.00
Avg. Training Pace	2	7:45	:21	7:30 - 8:00

TABLE 6

Means, Standard Deviations, and Ranges of Demographic Characteristics of Females (100-mile)

CHARACTERISTIC	NUMBER	MEAN	S.D.	RANGE
Age (years)	9	38.78	3.46	33.00 - 44.00
Height (inches)	9	64.78	1.99	61.00 - 68.00
Weight (lbs.)	9	119.44	7.00	110.00 - 132.00
% Body Fat	4	19.50	6.40	14.00 - 26.00
Years Running Competitively	9	7.78	2.22	5.00 - 11.00
Longest Race Run (miles)	9	81.22	20.57	50.00 - 102.00
Expected Race Time (hrs:mins)	9	25:17	2:37	23:00 - 30:00
Weeks Trained for Race	9	26.11	15.27	10.00 - 52.00
Miles/Week Trained	9	60.56	19.60	30.00 - 90.00
Longest Training Run	9	40.44	10.37	24.00 - 52.00
Avg. Training Pace (min:sec/mile)	9	9:13	:52	8:00 - 11:00
10 KM Time (mins:secs)	7	43:27	2:37	39:10 - 46:48
Marathon Time (hrs:mins)	9	3:42	:28	3:07 - 4:40

Demographics

Significant differences existed between survivors and casualties of the 50-mile race for mean body weight t (42) = 2.01, $p < .05$; years of competitive running t (41) = 3.13, $p < .01$; longest race run t (42) = 2.70, $p < .01$; expected race time t (42) = 3.77, $p < .001$; miles per week trained t (42) = 2.23, $p < .03$; and average training pace t (42) = 3.37, $p < .01$. Survivors weighed less, expected to run faster and trained longer and at faster paces than did casualties. They also had more years of competitive running and ran in longer races than casualties. Table 7 shows the means and level of significant difference up to $p < .05$ for the demographic characteristics of the 50-mile race.

Significant differences existed between survivors and casualties in the 100-mile race for mean body weight t (78) = 1.96, $p < .05$ and best marathon time within the past three years t (75) = 2.08, $p < .04$. Survivors weighed less and ran significantly faster in past marathons than did casualties. No other differences existed between survivors and casualties on any other demographic or training variables. Table 8 shows the means, standard deviations, and t-values for survivors and casualties in the 100-mile race.

Tables 9 and 10 are breakdowns of survivors and casualties previous ultramarathon experiences. The two groups differed significantly in the 50-mile race when the first three race categories are collapsed into two, i.e. categories zero, one, and 2 to 5 previous races became zero, and 1 to 5 previous races. This was necessary because of the small numbers in these cells. A χ^2 (3, N = 45) = 8.31, $p < .05$ was obtained. Further analysis utilizing the Mann-Whitney two-sample rank test examining the medians of

Table 7

Means And Standard Deviations Between Survivors And Casualties Of Demographic Characteristics and Level of Significant Difference (50-Mile)

Characteristic	Survivors Mean ± S.D. (N)	Casualties Mean ± S.D. (N)	T (DF)	SIG
Age (yrs)	37.53 ± 06.18 (17)	40.59 ± 07.78 (27)	1.37 (42)	NS
Height (inches)	70.12 ± 02.62 (17)	69.48 ± 03.51 (27)	0.64 (42)	NS
Weight (lbs.)	155.76 ± 16.88 (17)	165.85 ± 15.81 (27)	2.01 (42)	.05
% Body Fat	09.50 ± 03.04 (11)	11.94 ± 02.15 (08)	1.99 (17)	NS
Years Competitive Running	10.03 ± 03.74 (17)	06.70 ± 03.17 (26)	3.13 (41)	.01
Longest Race Run (miles)	85.86 ± 47.18 (17)	55.52 ± 27.40 (27)	2.70 (42)	.01
Expected Race Time (hrs:mins)	10:27 ± 01:00 (17)	11:58 ± 00:56 (27)	3.77 (42)	.001
Weeks Trained For Race	22.33 ± 18.81 (15)	16.81 ± 16.20 (26)	0.99 (39)	NS
Miles/Week Train	62.00 ± 24.51 (17)	48.37 ± 16.12 (27)	2.23 (42)	.03
Longest Training Run	25.20 ± 07.42 (17)	24.49 ± 08.78 (27)	0.28 (42)	NS
Average Training Pace (min:sec/mile)	07:28 ± 00:29 (17)	08:13 ± 00:50 (27)	3.37 (42)	.01

Table 8

Means And Standard Deviations Between Survivors And Casualties Of Demographic Characteristics and Level of Significant Difference (100-Mile)

Characteristic	Survivors Mean ± S.D. (N)	Casualties Mean ± S.D. (N)	T (DF)	SIG
Age (yrs)	39.83 ± 06.11 (48)	40.51 ± 09.66 (35)	0.37 (81)	NS
Height (inches)	68.77 ± 03.31 (48)	69.97 ± 03.62 (34)	1.56 (80)	NS
Weight (lbs.)	150.11 ± 20.77 (47)	159.21 ± 19.91 (33)	1.96 (78)	.05
% Body Fat	13.32 ± 05.58 (28)	14.00 ± 05.78 (14)	0.37 (40)	NS
Years Competitive Running	09.85 ± 04.07 (48)	08.94 ± 04.32 (35)	0.98 (81)	NS
Longest Race Run (miles)	90.13 ± 33.73 (48)	90.83 ± 48.75 (35)	0.08 (81)	NS
Expected Race Time (hrs:mins)	23:28 ± 02:12 (47)	24:12 ± 02:46 (34)	1.33 (79)	NS
Weeks Trained For Race	22.42 ± 15.99 (48)	22.24 ± 15.73 (33)	0.96 (79)	NS
Miles/Week Train	67.29 ± 22.65 (48)	64.26 ± 17.30 (35)	0.66 (81)	NS
Longest Training Run	37.21 ± 11.20 (47)	34.97 ± 13.38 (35)	0.41 (81)	NS
Average Training Pace (min:sec/mile)	08:11 ± 01:04 (48)	08:19 ± 01:04 (35)	0.50 (81)	NS
10 KM Time (mins:secs)	37:48 ± 03:58 (38)	39:06 ± 03:22 (30)	1.44 (66)	NS
Marathon Time (hrs:mins)	03:02 ± 00:23 (44)	03:13 ± 00:19 (33)	2.08 (75)	.04

TABLE 9

Relationship Between Ultramarathon Past Experience and Race Completition (50-MILE)

NUMBER OF PAST RACES	SURVIVOR		CASUALTY		TOTAL	
	N	%	N	%	N	%
None	1	2.2	6	13.3	7	15.5
1 to 5	1	2.2	2	4.4	3	6.7
6 to 10	3	6.7	10	22.2	13	28.9
More than 10	11	24.4	6	13.3	17	37.8

TABLE 10

Relationship Between Ultramarathon Past Experience And Race Completition (100-MILE)

NUMBER OF PAST RACES	SURVIVOR		CASUALTY		TOTAL	
	N	%	N	%	N	%
None	1	1.1	1	1.1	2	2.3
One	1	1.1	1	1.1	2	2.3
2 to 5	11	12.6	6	6.9	17	19.5
6 to 10	11	28.2	9	23.1	20	26.4
More than 10	25	28.7	18	20.7	43	49.4

survivors vs. casualties in race categories 1-5, i.e. from no to more than ten previous races, revealed a significant $\underline{W}$ = 497.0, $\underline{p} < .02$. No differences in frequency of past race experiences existed between survivors and casualties in the 100-mile race.

Profile of Mood States

The POMS questionnaire for the two races was analyzed using two separate repeated measures analysis of variance analyses for each race (four analyses in all). This was done because the number of individuals that had complete data for the five administrations was small; n=15 for the 50-mile, and n=14 for the 100-mile. However, it was deemed worthwhile to examine this data as well as examining just the pre and post data separately which takes advantage of a larger sample size. Means and standard deviations of the raw mood scores for each analysis classification may be found in Table A located in the Appendix. A summary of significant differences may be found by analysis classification in Table B also located in the Appendix.

Significant differences existed in the 50-mile race for the main effect of time of mood assessment for tension, vigor, fatigue, confusion and total mood disturbance over the five administrations. The actual F values may be found in Table B located in the Appendix. Figures 1 and 2 graphically represent mood profiles over the five administrations for the 50-mile and 100-mile races respectively. Duncan's multiple comparison tests were used to isolate the location of the significant difference between the five administrations for the mood states of tension, vigor, fatigue, confusion and total mood disturbance for the 50-mile race. The critical values for Duncan's test with an error

FIGURE 1: PROFILE OF MOOD STATES (50-MILE)

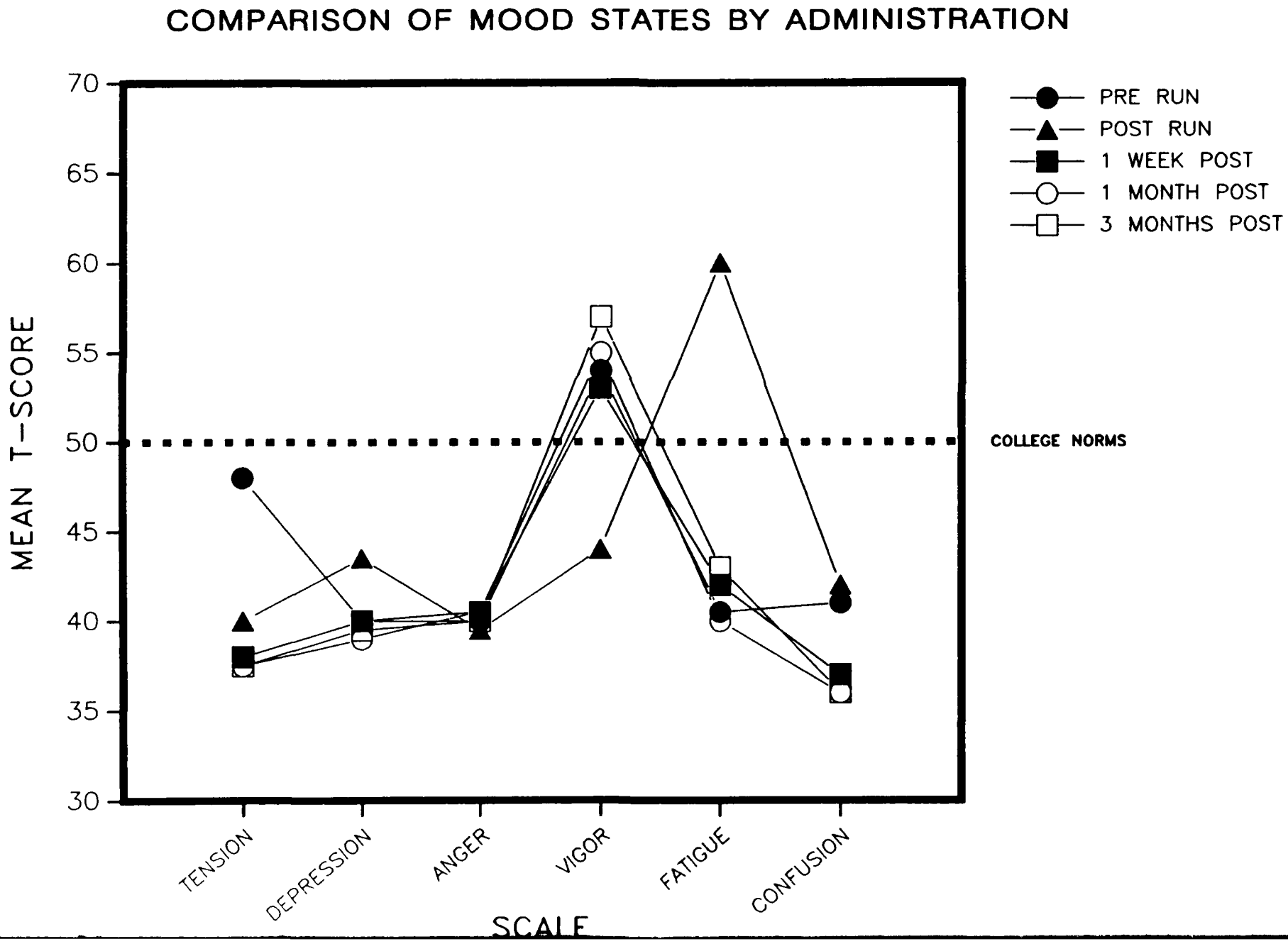
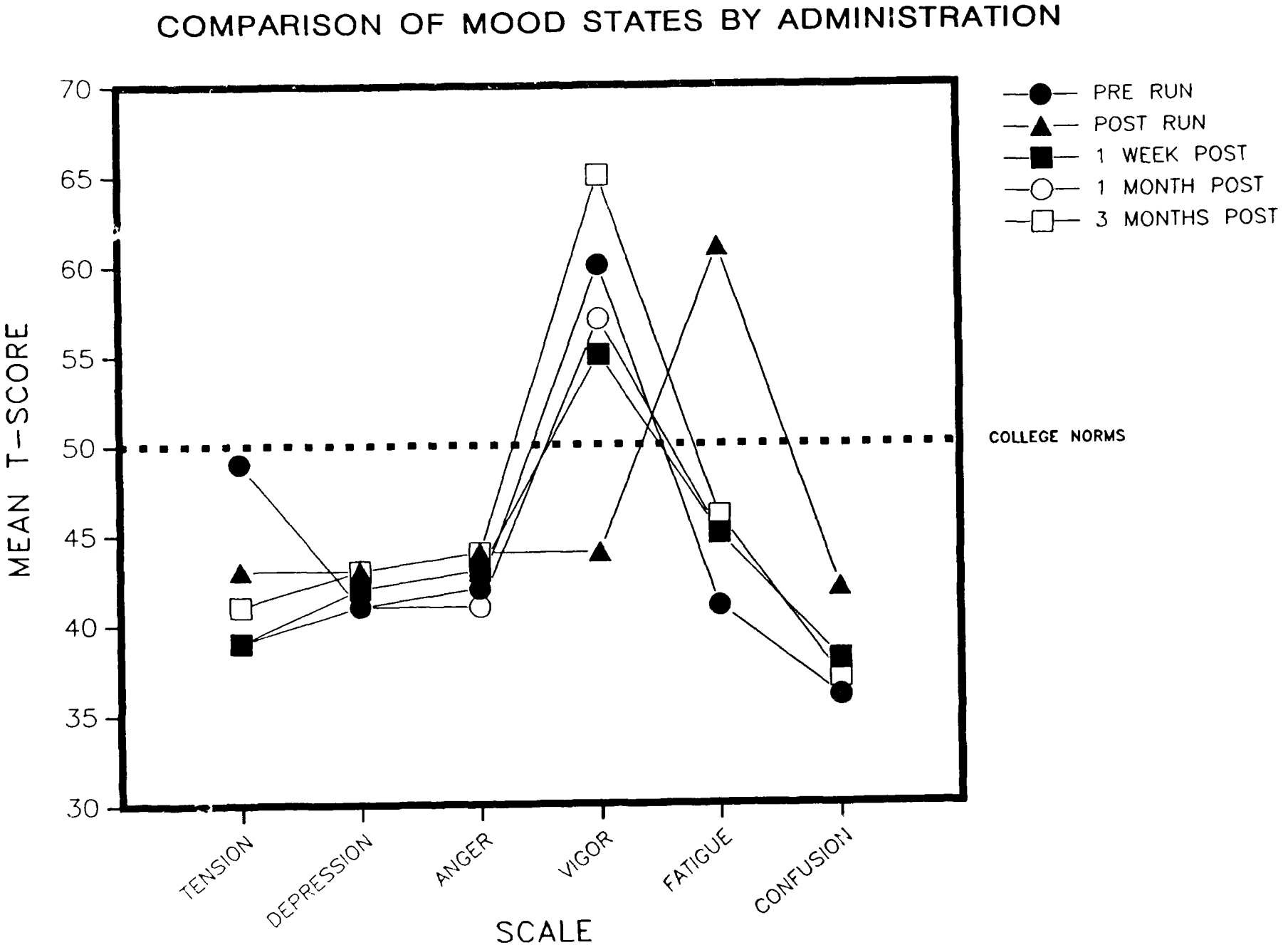


FIGURE 2: PROFILE OF MOOD STATES (100-MILE)



degrees of freedom of 52 and five means being tested range from 2.83 to 3.14 for $p < .05$ and 3.76 to 4.12 for $p < .01$ level of significance respectively. Tension was found to be significantly greater prerun than any of the four postrun values at $p < .01$ level of significance. Vigor was found to be significantly lower immediately postrun at $p < .01$ level of significance. Fatigue was found to be significantly increased immediately postrun at the $p < .01$ level of significance. Confusion was significantly lower, $p < .05$, one month and three months postrun from the level of confusion reported immediately postrun. A comparison of mood states by time of administration is illustrated in Figure 1. Total mood disturbance was significantly greater immediately postrun than either prerun $p < .05$ or the other three postrun measures all at the $p < .01$ level of significance.

Duncan's multiple comparison tests were also used to isolate the location of significant differences between mood states for the main effect of time of administration on tension, vigor, fatigue and total mood disturbance score during the 100-mile race. The actual F values and level of significance may be found in Table B located in the Appendix. The critical values for Duncan's with an error degrees of freedom of 48 with five means being tested range from 2.86 to 3.17 for $p < .05$ and 3.82 to 4.17 for the $p < .01$ level of significance respectively. Tension was significantly greater prerun than any of the four postrun values at the $p < .01$ level except immediately postrun which was significant at the $p < .05$ level. Vigor was found to be significantly lower immediately postrun than prerun, one month postrun, or three months postrun at the $p < .05$ level of significance. Fatigue was found to be significantly greater immediately postrun compared to the other four administrations at the p

< .01 level of significance. These significant differences may be seen graphically from Figure 2. Total mood disturbance score was significantly greater immediately postrun, $p < .01$ when compared to the other administrations. No other comparisons proved significant except those stated.

Figures 3 and 4 graphically depict pre and postrun mood states for the 50 and 100-mile races respectively. In the 50-mile race, tension F (1,34) = 21.99, $p < .001$ and vigor F (1,34) = 27.74, $p < .001$ levels were significantly lower, while fatigue F (1,34) = 86.61, $p < .001$ and total mood disturbance F (1,34) = 8.48, $p < .01$ were significantly elevated postrun. These differences may be observed from Figure 3. Depression F (1,28) = 9.61, $p < .01$, fatigue F (1,28) = 43.34, $p < .001$, confusion F (1,28) = 43.39, $p < .001$ and total mood disturbance score F (1,28) = 25.38, $p < .001$, were significntly elevated postrun while vigor F (1,28) = 63.74, $p < .001$, was significantly lower postrun in the 100-mile run. These changes may be observed graphically in Figure 4.

Differences in fatigue (50-mile race) between survivors and casualties approached significance F (1,34) = 3.03, $p < .09$ with survivors exhibiting more fatigue than casualties. However, a significant interaction existed F (1,34) = 6.60 $p < .01$ between time of administration and group effects for fatigue during the 50-mile race. The interaction effect is displayed in Figure 5. As can be seen, survivors started out feeling less fatigued but by the end of the race were more fatigued than runners who later became casualties. No other interaction or group differences existed for the 50-mile race when examining pre and postrun scores only.

Figure 6 illustrates mood states for the 50 and 100-mile race for survivors and casualties. In general, the prerun mood profile is similar for

FIGURE 3: PROFILE OF MOOD STATES (50-MILE)

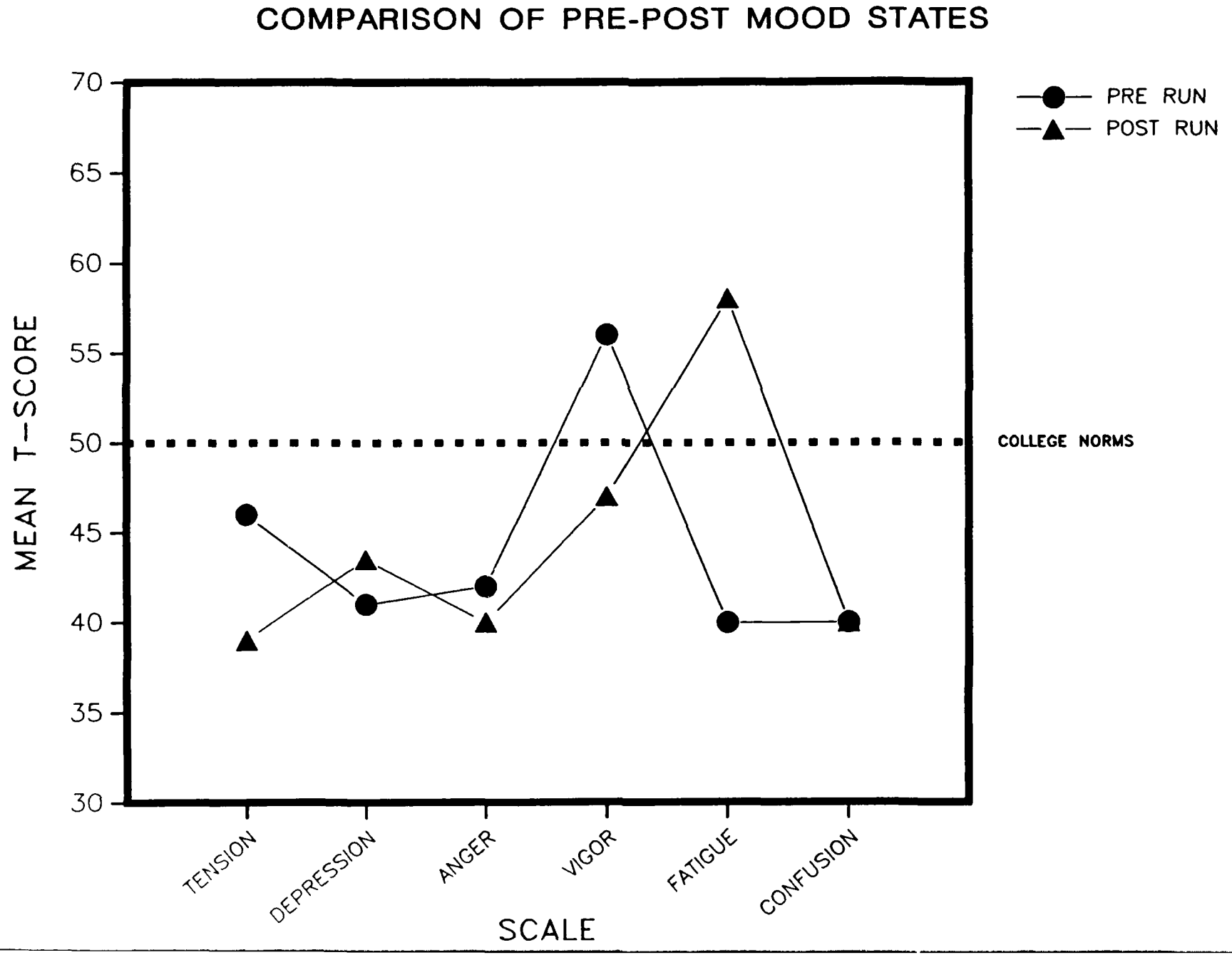


FIGURE 4: PROFILE OF MOOD STATES (100-MILE)

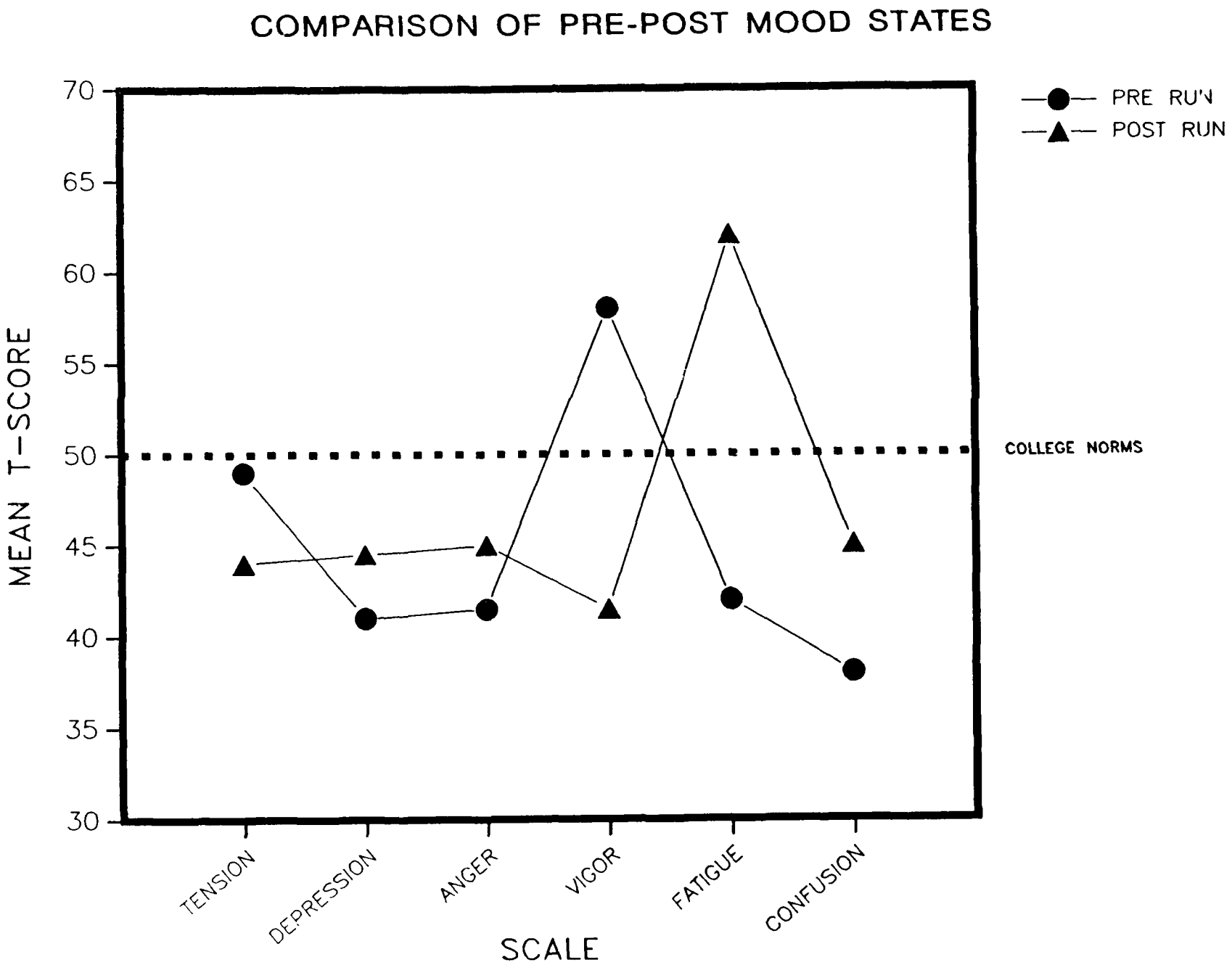


FIGURE 5

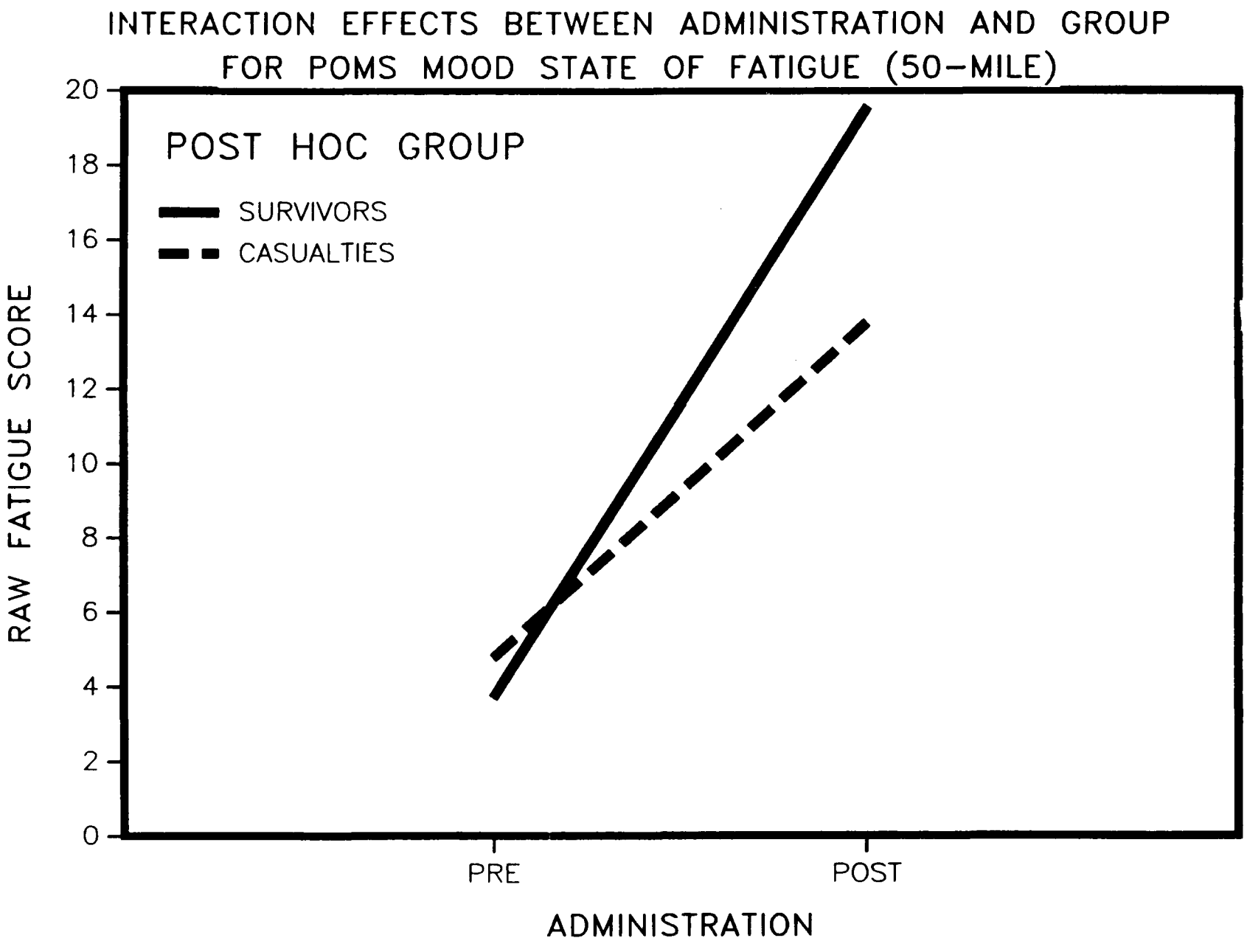
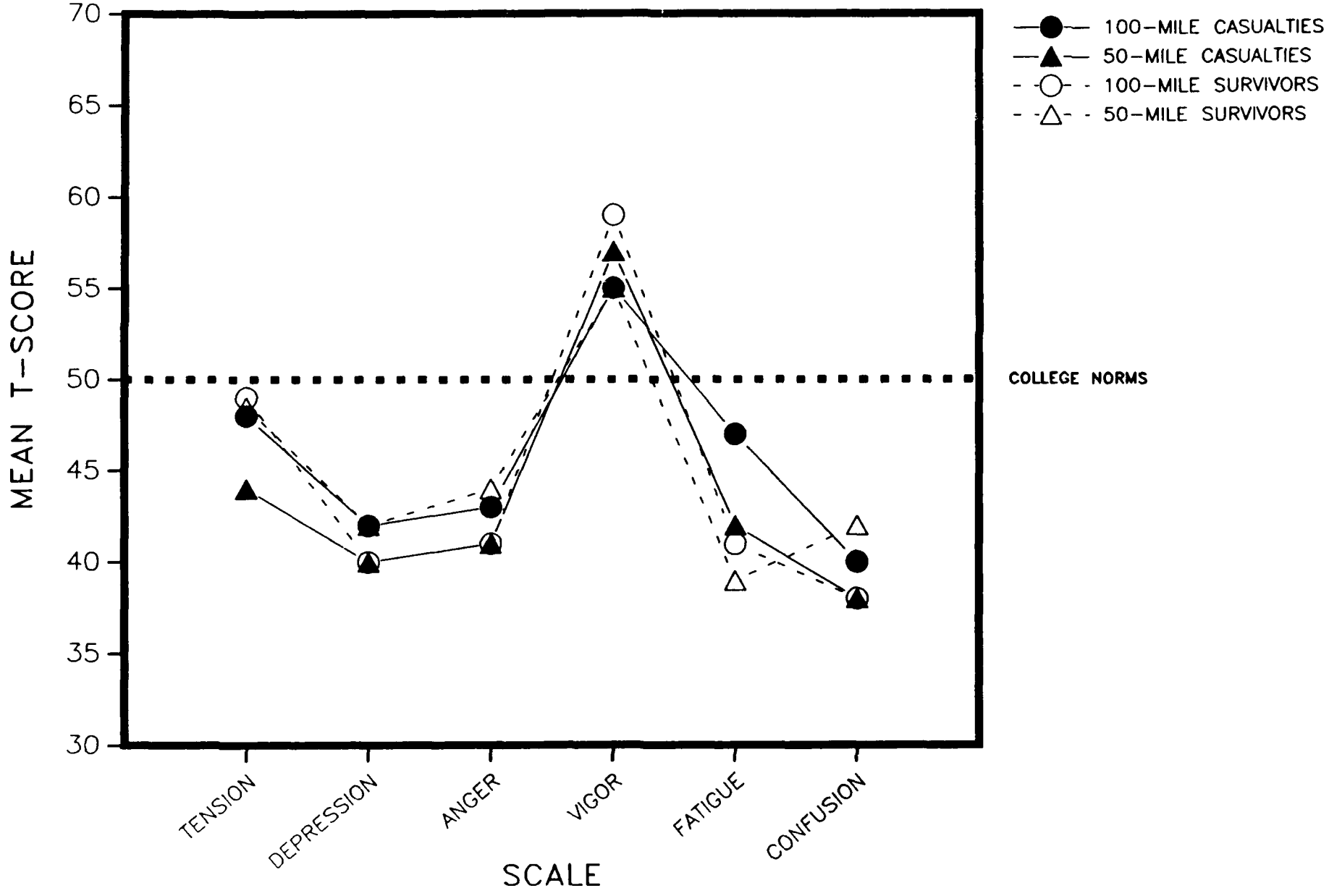

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR POMS MOOD STATE OF FATIGUE (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
RAW FATIGUE SCORE
20
18
16
14
12
10
8
6
4
2
0
PRE
POST
ADMINISTRATION

FIGURE 6: PROFILE OF MOOD STATES

PRE RUN MOODS FOR SURVIVORS AND CASUALTIES



all groups and resembles the "iceberg profile" seen in athletes with the exception of a somewhat elevated tension score. Figure 7 shows the postrun mood states for both the 50 and 100-mile race survivors and casualties. Figure 8 represents the significant interaction effect between group and time of administration found for tension in the 100-mile race $\underline{F}$ (1,28) = 5.46, $\underline{p} < .03$. Tension levels for survivors dropped dramatically while tension levels for casualties actually increased slightly upon dropping out of the race. Depression and fatigue interaction effects between group and time of administration approached significance with $\underline{F}$ (1,28) = 3.50, $\underline{p} < .07$ and $\underline{F}$ (1,28) = 3.00, $\underline{p} < .09$ levels of significance achieved respectively. Figures 9 and 10 illustrate these differences in the way the two groups responded over the course of the time respectively. Finally a significant difference existed between groups on depression $\underline{F}$ (1,28) = 4.19, $\underline{p} < .05$, and vigor $\underline{F}$ (1,28) = 3.85, $\underline{p} < .05$. Casualties reported less vigor and more depression than did survivors.

Environmental Symptomatology

Survivors exhibited stronger symptom intensities than casualties in the 50-mile race, for the following symptoms: muscle cramps $\underline{F}$ (1,13) = 5.13, $\underline{p} < .05$; muscles feeling tight $\underline{F}$ (1,13) = 7.47, $\underline{p} < .02$; coordination off $\underline{F}$ (1,13) = 5.11, $\underline{p} < .05$; and mouth is dry $\underline{F}$ (1,13) = 4.89, $\underline{p} < .05$. Tables C and D in the Appendix offer a summary of the means and significant differences between time of administration and groups respectively for the 41 symptoms queried in conjunction with running the 50-mile race. Twenty-six of the symptoms showed a significant change for the main effect of time of administration. Each

FIGURE 7: PROFILE OF MOOD STATES

POST RUN MOODS FOR SURVIVORS AND CASUALTIES

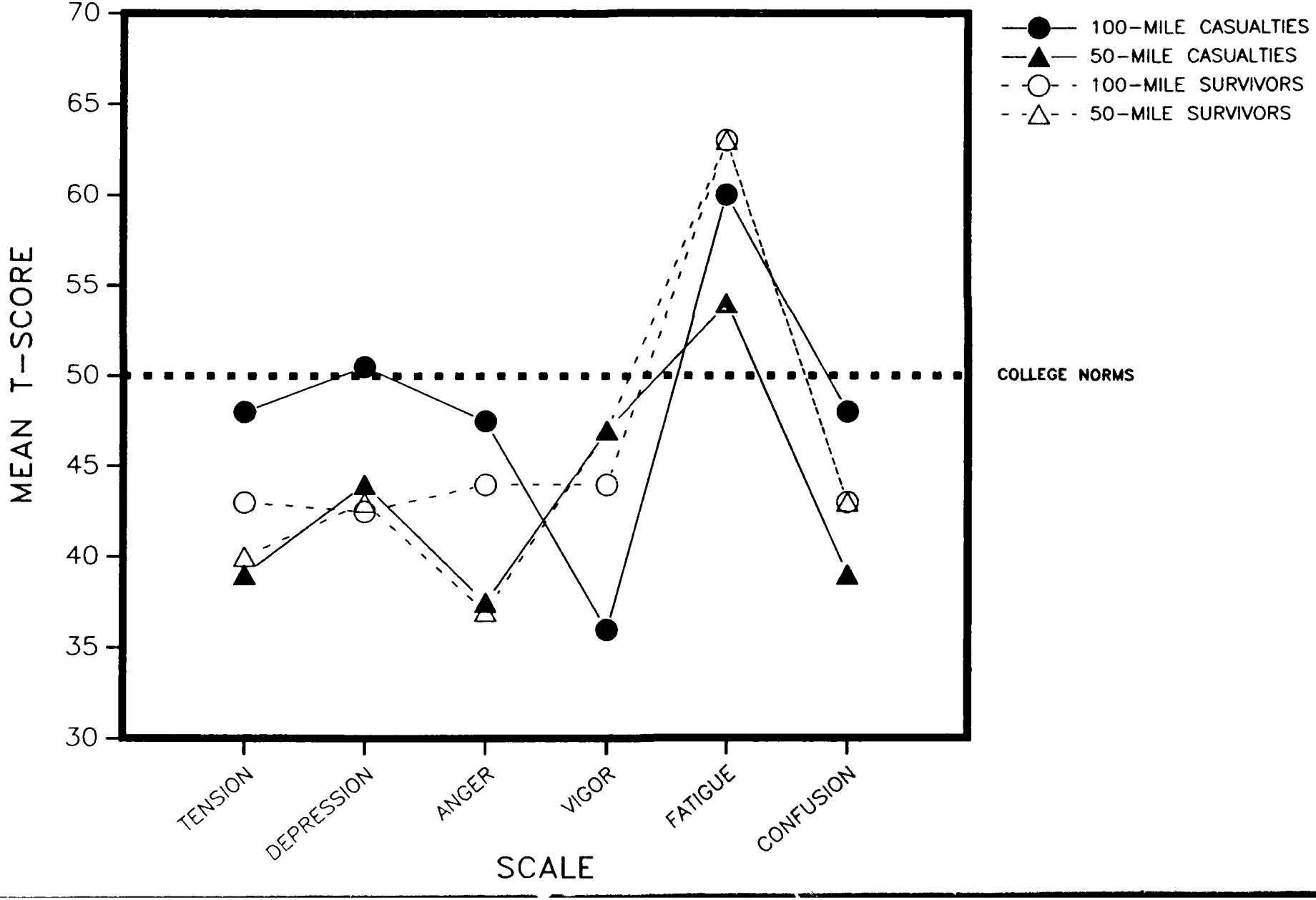


FIGURE 8

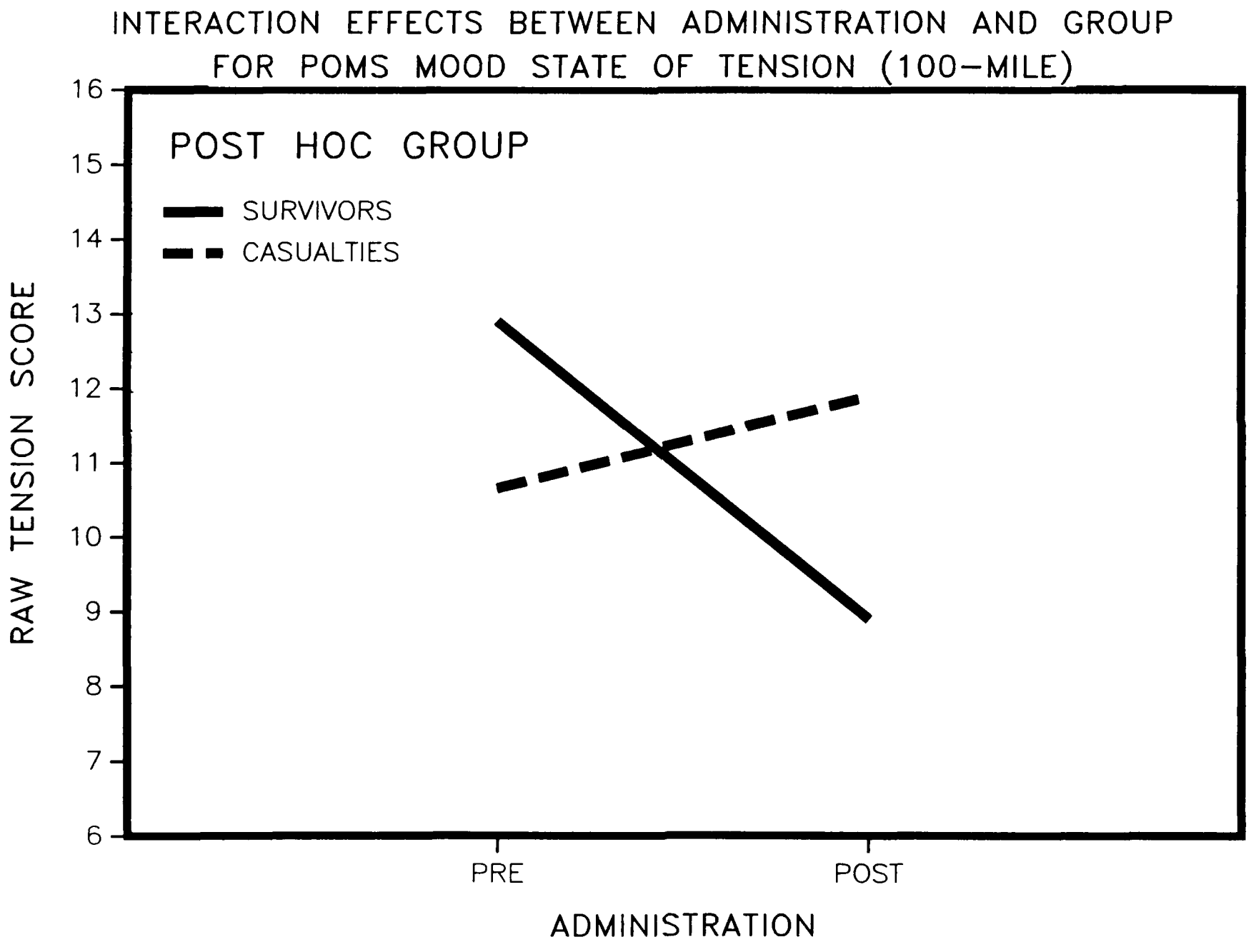

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR POMS MOOD STATE OF TENSION (100-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
RAW TENSION SCORE
16
15
14
13
12
11
10
9
8
7
6
PRE
POST
ADMINISTRATION

FIGURE 9

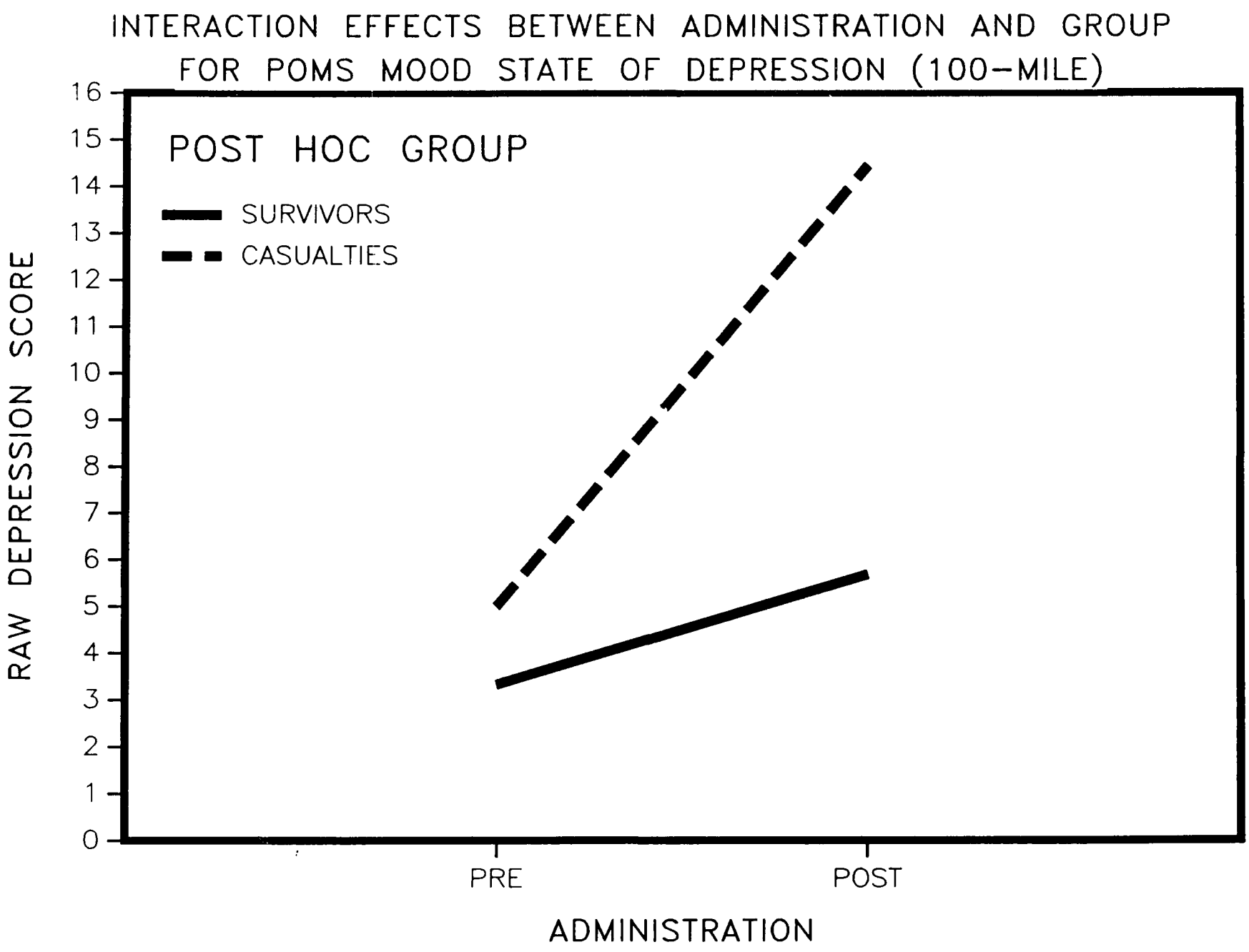
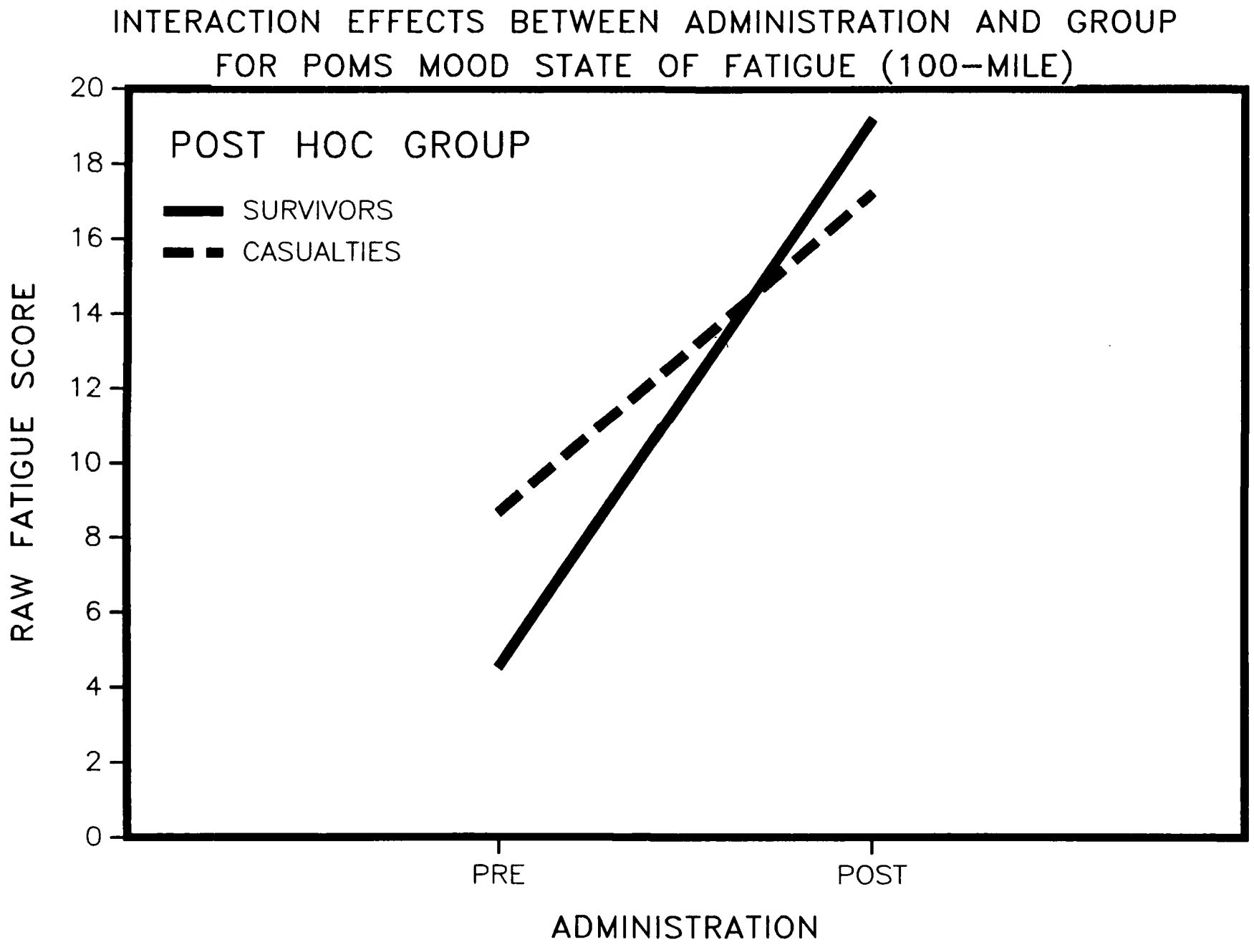

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR POMS MOOD STATE OF DEPRESSION (100-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
RAW DEPRESSION SCORE
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
PRE
POST
ADMINISTRATION

FIGURE 10


INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR POMS MOOD STATE OF FATIGUE (100-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
RAW FATIGUE SCORE
20
18
16
14
12
10
8
6
4
2
0
PRE
POST
ADMINISTRATION

symptom score was anchored with a "0" indicating the absence of a symptom, "1" the presence of a symptom of slight intensity, "2" a symptom being somewhat intense, "3" moderate symptom intensity, "4" quite a bit of symptom intensity, and "5" extreme symptom intensity.

Significant group x time of administration interactions were found for muscle cramps $\underline{F}$ (4,52) = 4.58, $\underline{p} < .005$; muscles feel tight $\underline{F}$ (4,52) = 3.79, $\underline{p} < .01$; body aches $\underline{F}$ (4,52) = 6.26, $\underline{p} < .001$; coordination off $\underline{F}$ (4,52) = 2.76, $\underline{p} < .04$; thirsty $\underline{F}$ (4,52) = 4.34, $\underline{p} < .005$; and feel restless $\underline{F}$ (4,52) = 3.21, $\underline{p} < .01$. These interaction effects are depicted graphically in Figures 11-16.

No differences between survivors and casualties competing in the 100-mile race existed. However, five symptoms approached significance, i.e. values were between $\underline{p} < .05$ and .10, (short of breath, hard to breathe, feel faint, feel sick, and feeling depressed). Casualties reported a greater symptom intensity than survivors for all five of these symptoms. Thirty of the symptoms showed a significant main effect for time of administration. Tables E and F in the Appendix show a summary of the means and significant differences between time of administration and groups respectively for the 41 symptoms assessed in the 50-mile race. There were no significant group x time of mood administration interactions.

Tables 11 and 12 show symptoms that were present (i.e. having a mean $\geq$ 1.0), over time of administration for the 50 and 100 mile races. Prior to the 50-mile race there were only four symptoms which had an average symptom intensity of at least "slight". All four symptoms were related to feeling tired. After the run 18 symptoms were present with intensities ranging from "slight" to "quite a bit". By one week postrun only three symptoms existed

FIGURE 11

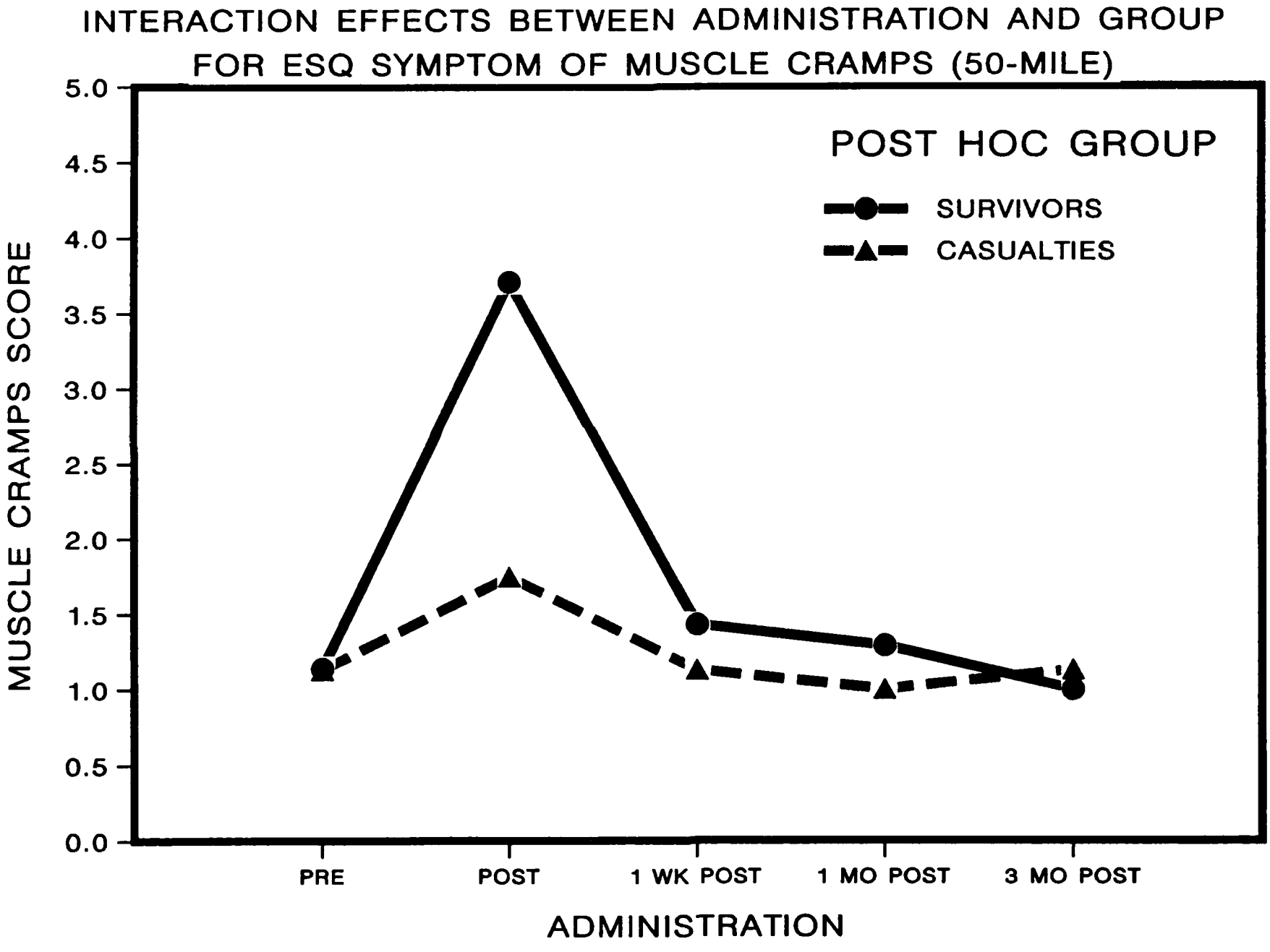

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR ESQ SYMPTOM OF MUSCLE CRAMPS (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
MUSCLE CRAMPS SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
1 WK POST
1 MO POST
3 MO POST
ADMINISTRATION

FIGURE 12

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP FOR ESQ SYMPTOM OF MUSCLES FEEL TIGHT (50-MILE)

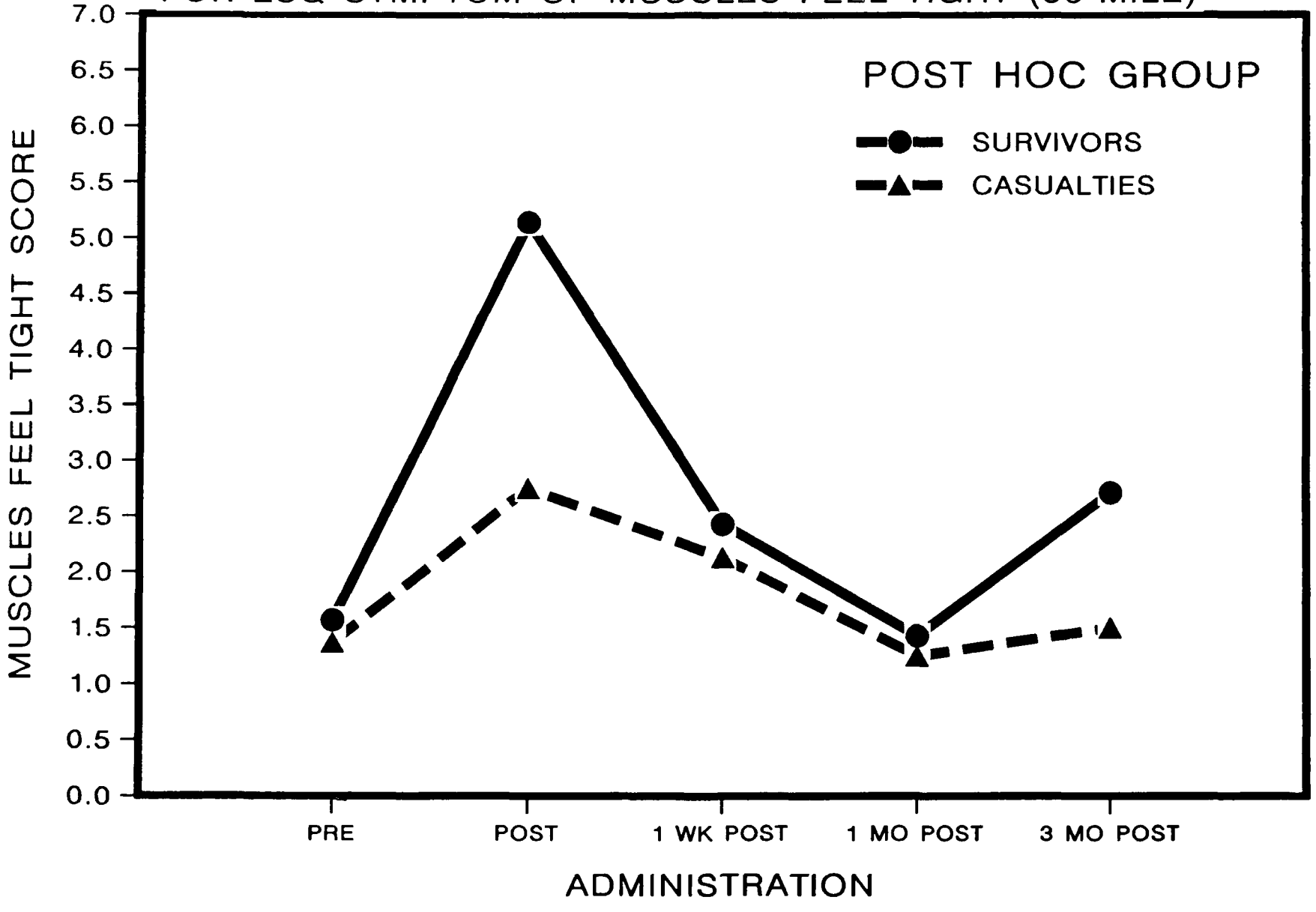


FIGURE 13

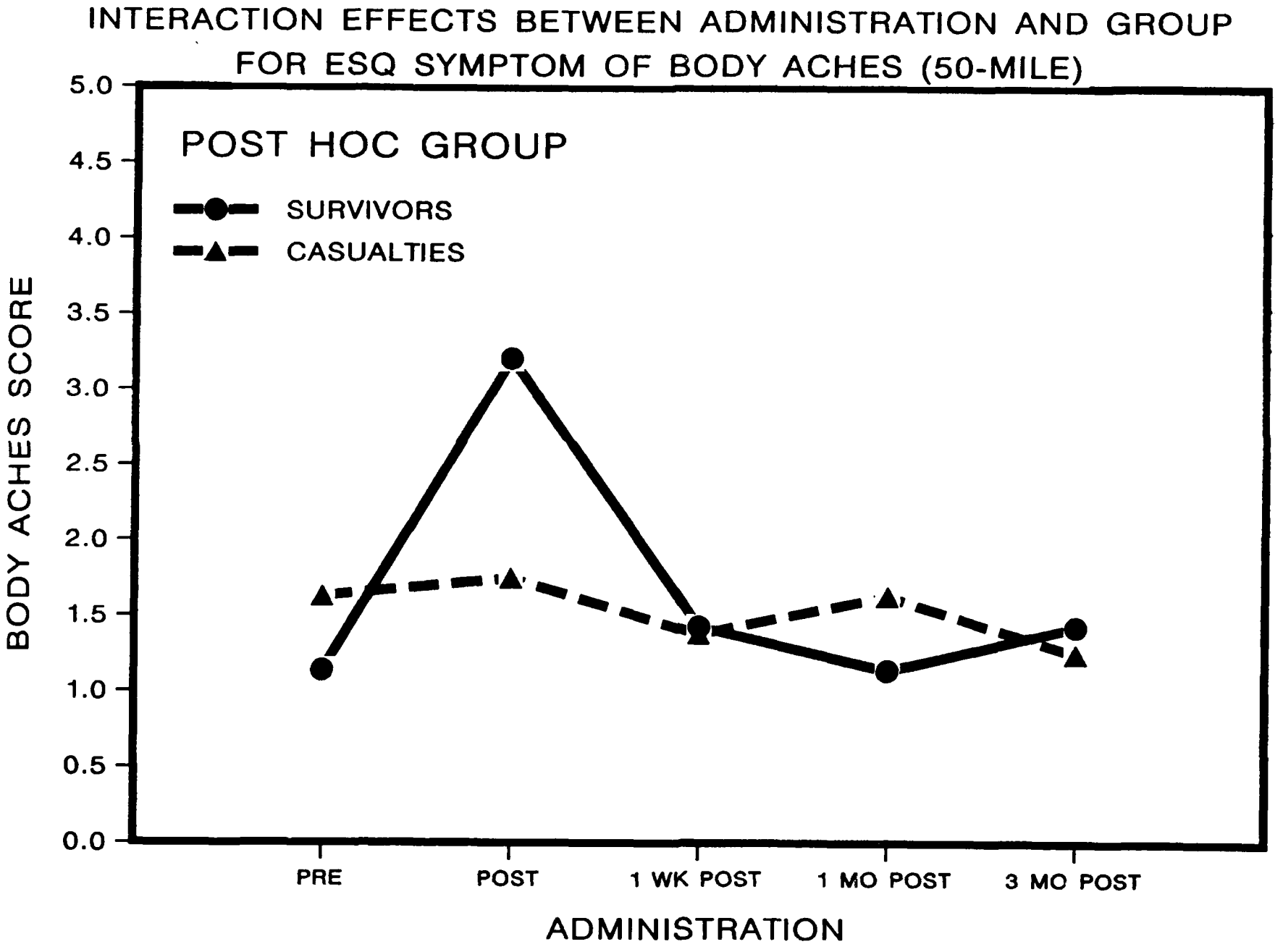

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR ESQ SYMPTOM OF BODY ACHES (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
BODY ACHES SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
1 WK POST
1 MO POST
3 MO POST
ADMINISTRATION

FIGURE 14

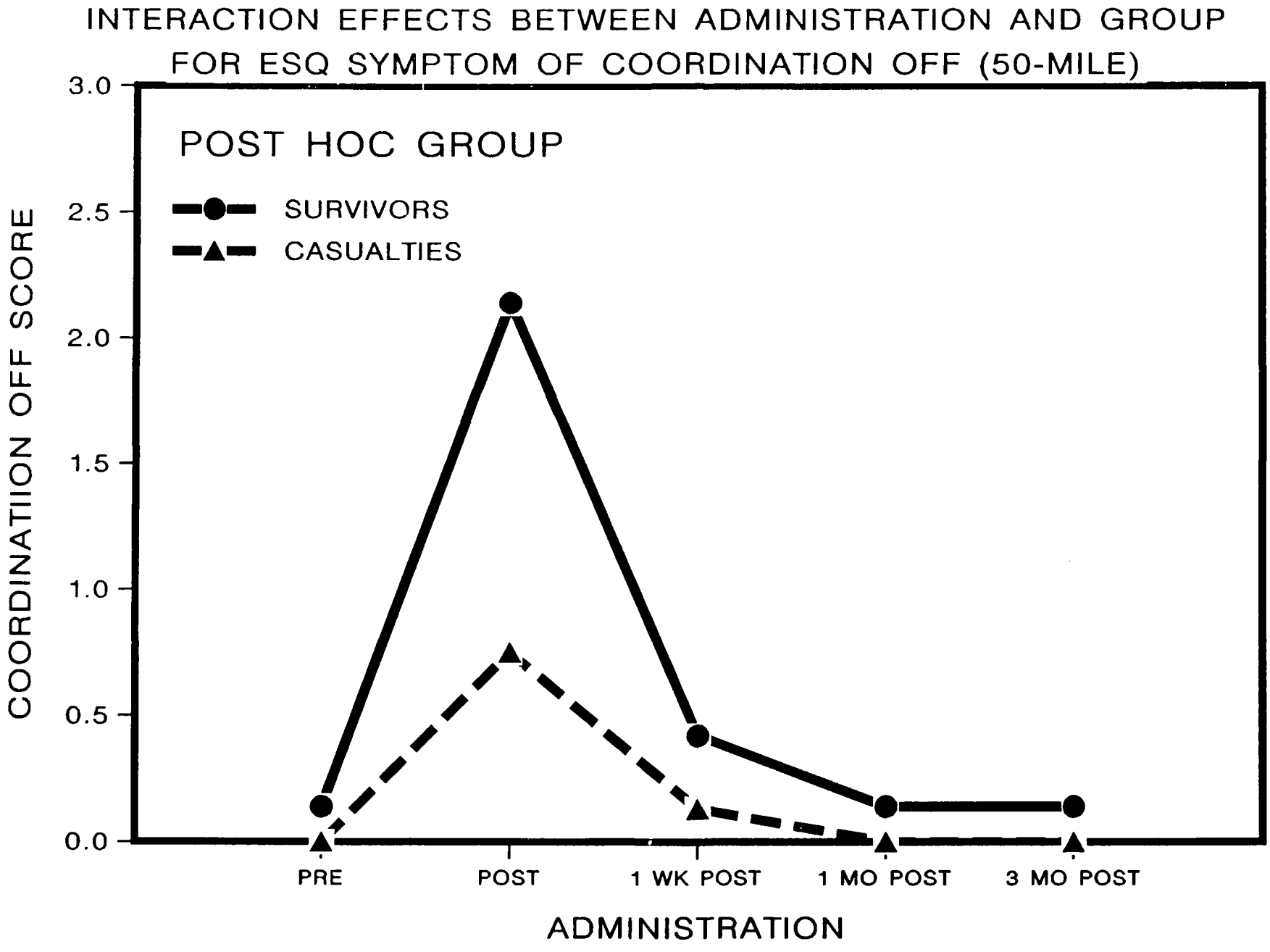

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR ESQ SYMPTOM OF COORDINATION OFF (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
COORDINATIION OFF SCORE
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
1 WK POST
1 MO POST
3 MO POST
ADMINISTRATION

FIGURE 15

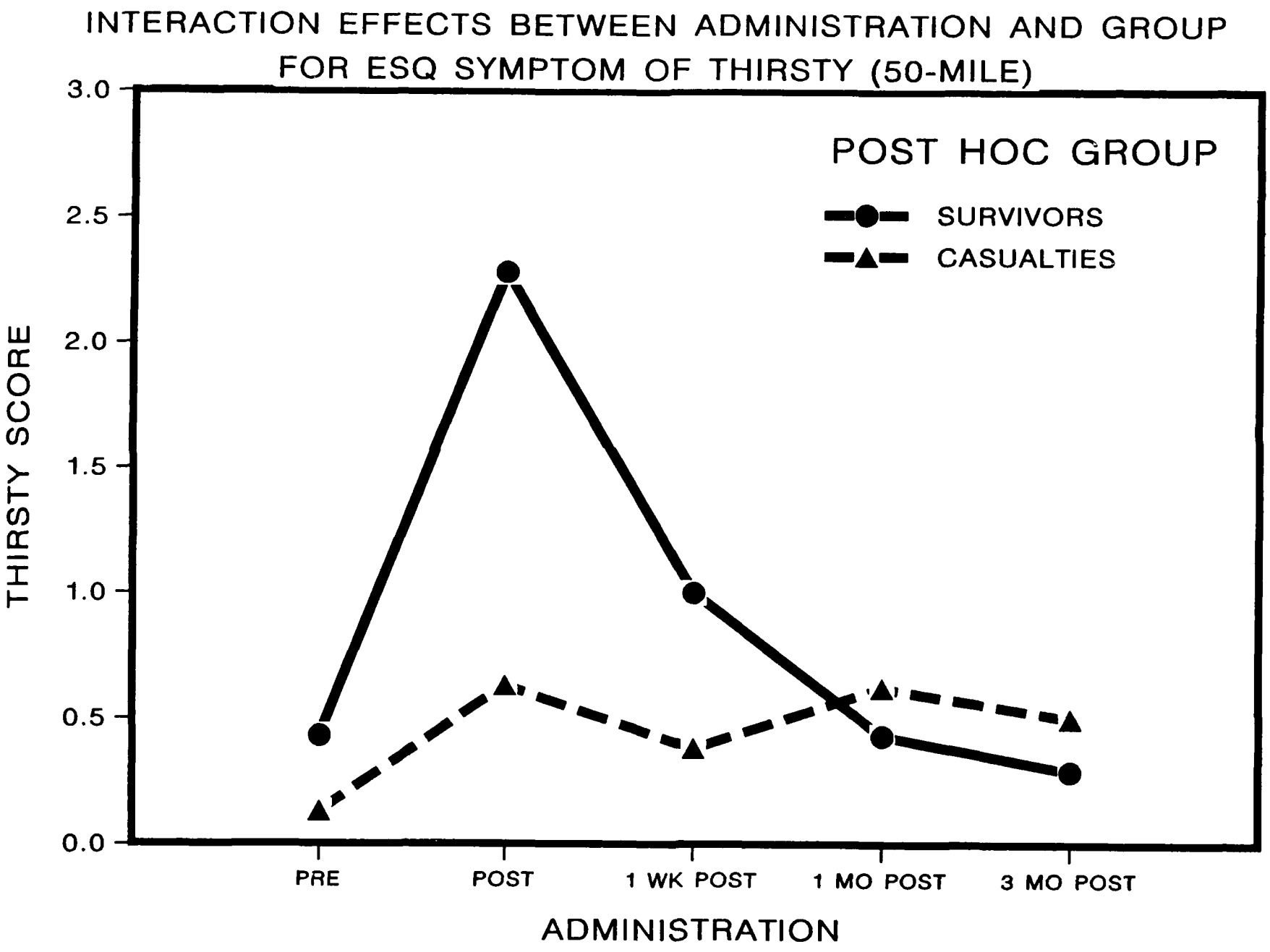

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR ESQ SYMPTOM OF THIRSTY (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
THIRSTY SCORE
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
1 WK POST
1 MO POST
3 MO POST
ADMINISTRATION

FIGURE 16

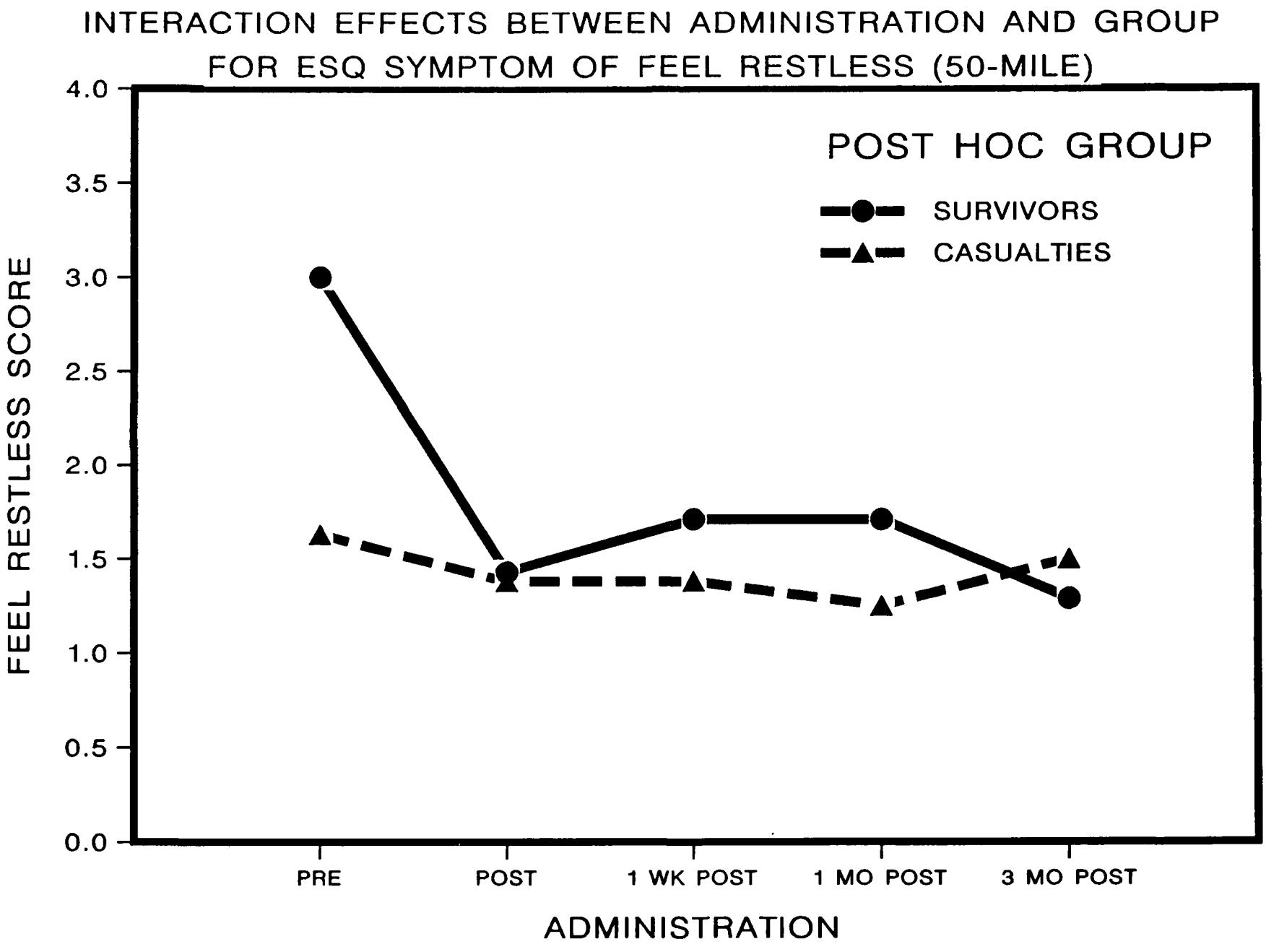

INTERACTION EFFECTS BETWEEN ADMINISTRATION AND GROUP
FOR ESQ SYMPTOM OF FEEL RESTLESS (50-MILE)
POST HOC GROUP
SURVIVORS
CASUALTIES
FEEL RESTLESS SCORE
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
PRE
POST
1 WK POST
1 MO POST
3 MO POST
ADMINISTRATION

TABLE 11

Rank Order of Complaints Expressed With a Symptom Intensity Greater Than 1.0 (Or a Rating of Slight) for the 50-Mile Race

Pre-Race	Post-Race	1-Week Post	1-Month Post	3-Months Post
1. Feel Restless	1. Legs/Feet Ache	1. Feel Tired		1. Couldn't Sleep Well
2. Feel Sleepy	2. Feel Tired	2. Muscles Tight		2. Feel Tired
3. Feel Tired	3. Muscles Tight	3. Feel Weak		3. Muscles Tight
4. Couldn't Sleep Well	4. Feel Weak			4. Feel Warm
	5. Muscle Cramps			
	6. Back Cramps			
	7. Lost Appetite			
	8. Upper Body Aches			
	9. Feel Sleepy			
	10. Coordination Off			
	11. Thirsty			
	12. Sick to Stomach			
	13. Short of Breath			
	14. Hard to Breathe			
	15. Concentration Off			
	16. Feel Sick			
	17. Feel Lightheaded			
	18. Mouth is Dry			

TABLE 12

Rank Order of Complaints Expressed With a Symptom Intensity Greater Than 1.0 (Or a Rating of Slight) for the 100-Mile Race

Pre-Race	Post-Race	1-Week Post	1-Month Post	3-Months Post
	1. Feel Weak	1. Feel Weak		1. Muscle Cramps
	2. Thirsty	2. Muscle Cramps		2. Thirsty
	3. Muscle Cramps	3. Vision Dim		3. Feel Weak
	4. Feel Sleepy	4. Couldn't Sleep Well		4. Feel Hungover
	5. Muscles Tight			
	6. Hurts to Breathe			
	7. Couldn't Sleep Well			
	8. Gas Pressure			
	9. Mouth is Dry			
	10. Lost Appetite			
	11. Legs/Feet Hurt			
	12. Coordination Off			
	13. Vision Dim			
	14. Stomach Cramps			
	15. Upper Body Aches			
	16. Back Aches			
	17. Concentration Off			
	18. Stomach Aches			
	19. Feel Hungover			
	20. Feel Warm			
	21. Body Parts Numb			
	22. Feel Sweaty			
	23. Nose Stuffed Up			
	24. Feel Restless			

with an intensity of equal or greater than "slight". One month after the race no symptoms were reported greater than "slight" in intensity. The 100-mile results show the same pattern as the 50-mile. No symptoms were reported prerace with an intensity of equal or greater than "slight". However, immediately postrace there were 24 symptoms equal or greater than "slight" intensity while one week postrace only four symptoms were reported as equal or greater than "slight" intensity. One month after the race there were no symptoms reported.

Coping Strategies

Significant differences in the frequency of two strategies used between survivors and casualties were found in the 50-mile race; they are "focused on maintaining running form" χ^2 (1, $\underline{N}$ = 59) = 3.88, $\underline{p} < .05$ and "considered dropping out of the race" χ^2 (1, $\underline{N}$ = 59) = 4.21, $\underline{p} < .05$. Significantly more survivors than casualties used the first strategy whereas a significantly greater number of casualties thought about "dropping out of the race" than survivors did before they actually dropped out. In the 100-mile race a significant difference in the frequency of the strategy used between groups was found for considering dropping out of the race (favoring casualties) χ^2 (1, $\underline{N}$ = 35) = 9.94, $\underline{p} < .001$. A complete list of the frequency of use, and helpfulness broken down by race, group, and strategy may be found in Table G in the Appendix.

In the 100-mile race no significant differences were observed using a t-test in the total number of strategies used between groups. In addition, no differences in total number of strategies used were observed when considering

pre or during-race strategies only. Furthermore, when the questionnaire was divided into the five categories, no significant differences were observed between groups in total number of strategies used.

Although there were no differences between the number of strategies used, survivors reported significantly more of the strategies that they did use as being helpful than casualties, t (33) = 2.40 $p < .05$ (see Figure 17). In addition, survivors reported significantly more strategies as being helpful than casualties when strategies were broken down and examined by the following subsets of strategies: prerace (see Figure 18), psychological and training (see Figure 19), and dietary; all significant at the $p < .05$ level (pre-race t (33) = 3.67, psychological t (33) = 2.02, training t (33) = 2.42, and dietary t (33) = 2.10). A summary of the mean number of coping strategies used and helped may be found in Table H located in the Appendix.

Strategies were rank ordered by the percent of subjects in each group that used a particular strategy. The most dramatic differences in the rank order occurred for the following strategies: 1) congratulated oneself after attaining an intermediate goal, 2) had friends and familiar faces on the course, 3) focused on maintaining running form, 4) had planned breaks for food and drink, 5) constantly adjusted pace, and 6) considered dropping out of the race. Survivors had a greater percentage of people using the first four, while casualties had a greater percentage of people using the latter two as may be seen from Figure 20. Table I in the Appendix is the complete rank order by group of the strategies used.

FIGURE 17

MEAN NUMBER OF COPING STRATEGIES USED AND HELPED (100-MILE)

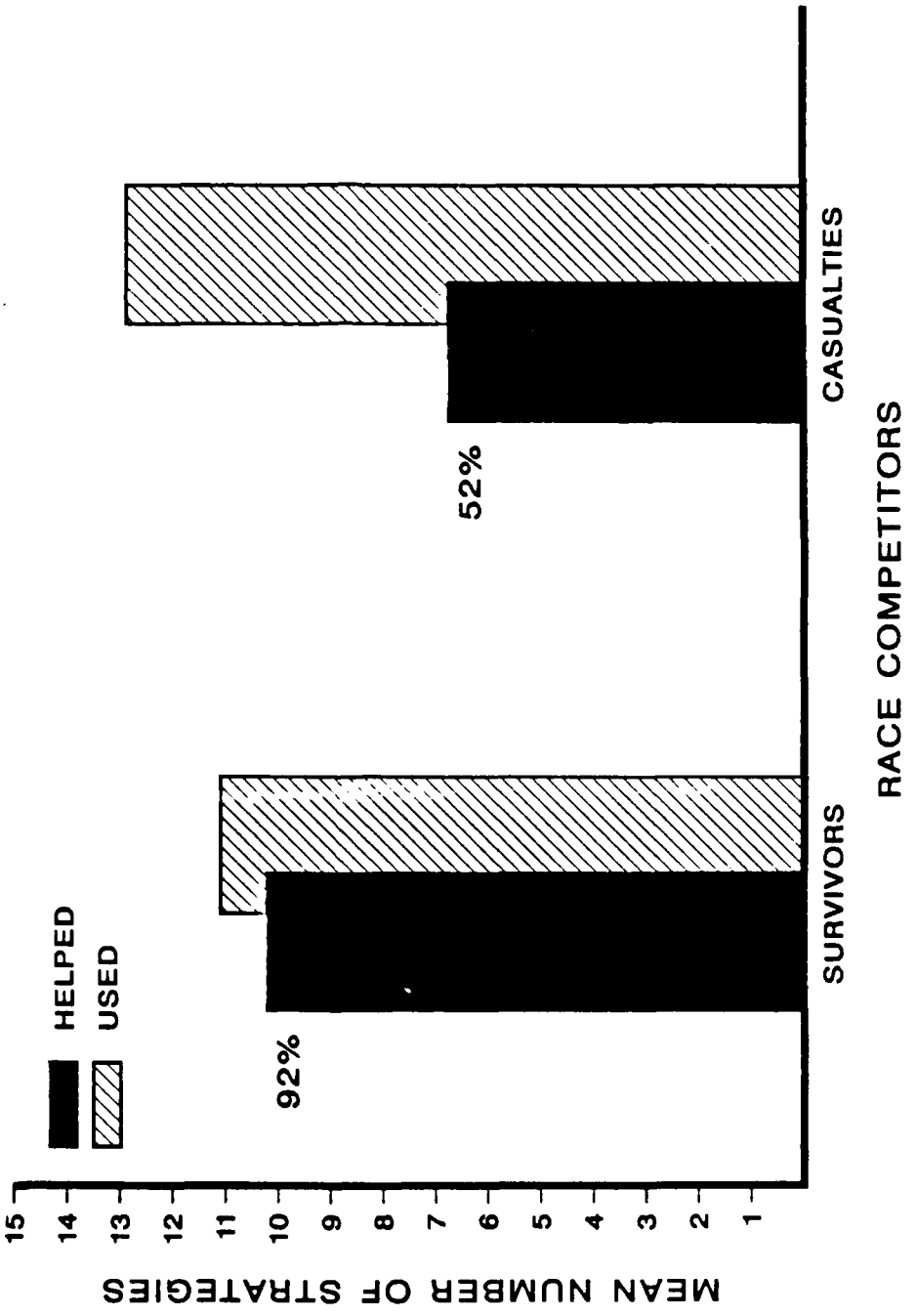


FIGURE 18

MEAN NUMBER OF PRE-RACE COPING STRATEGIES USED AND HELPED (100-MILE) (13 TOTAL)

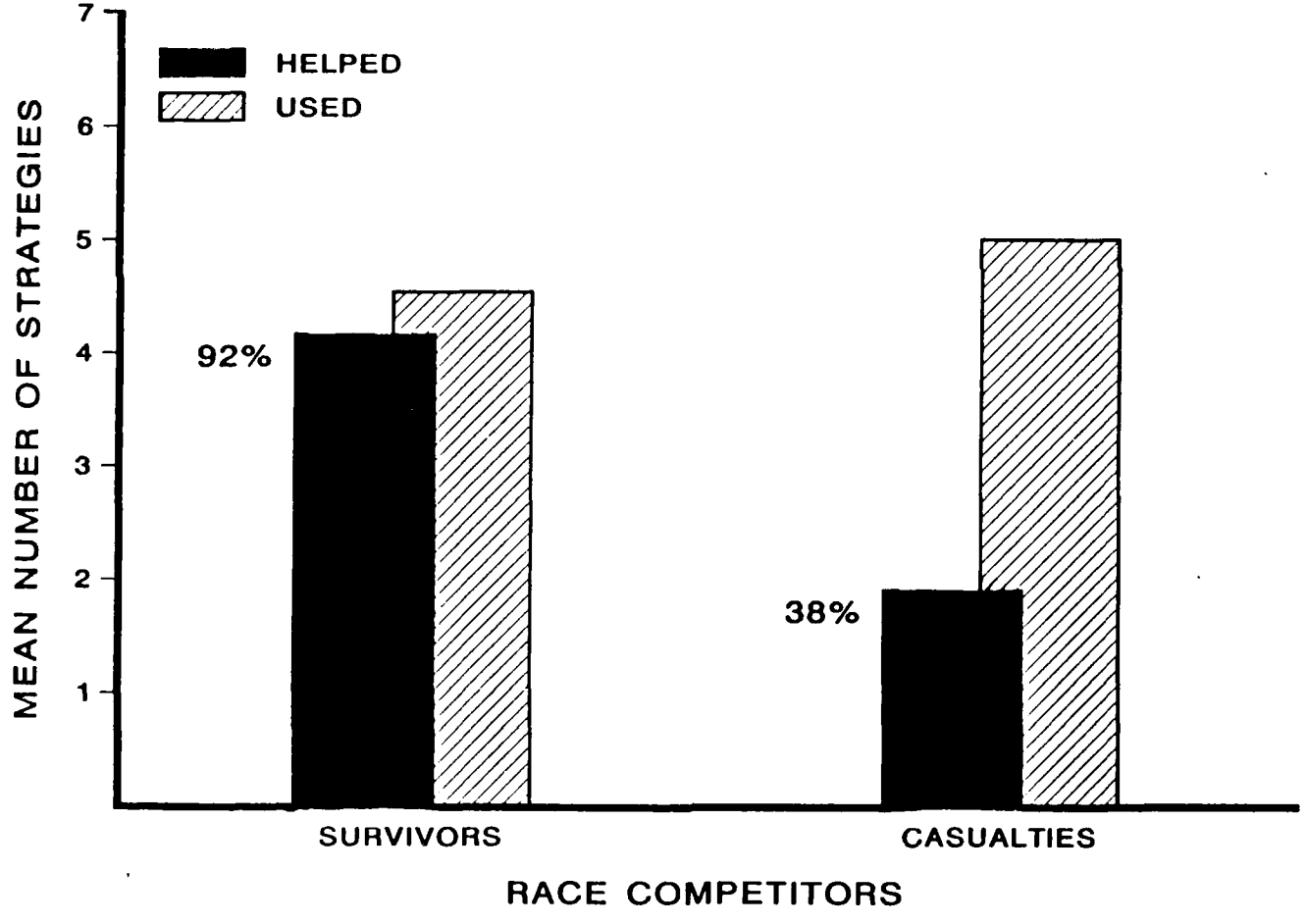


FIGURE 19

MEAN NUMBER OF COPING STRATEGIES USED AND HELPED (100-MILE)

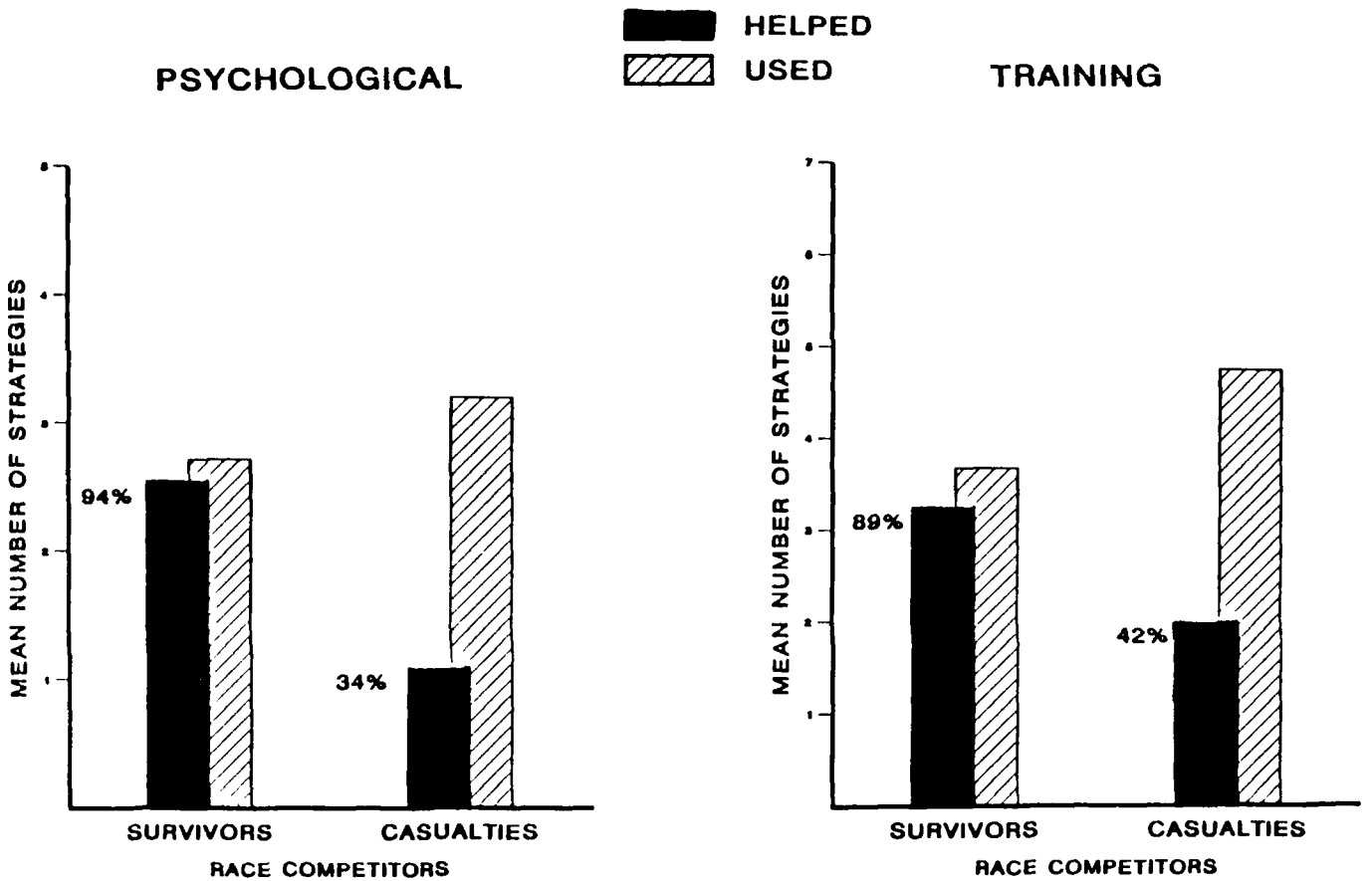
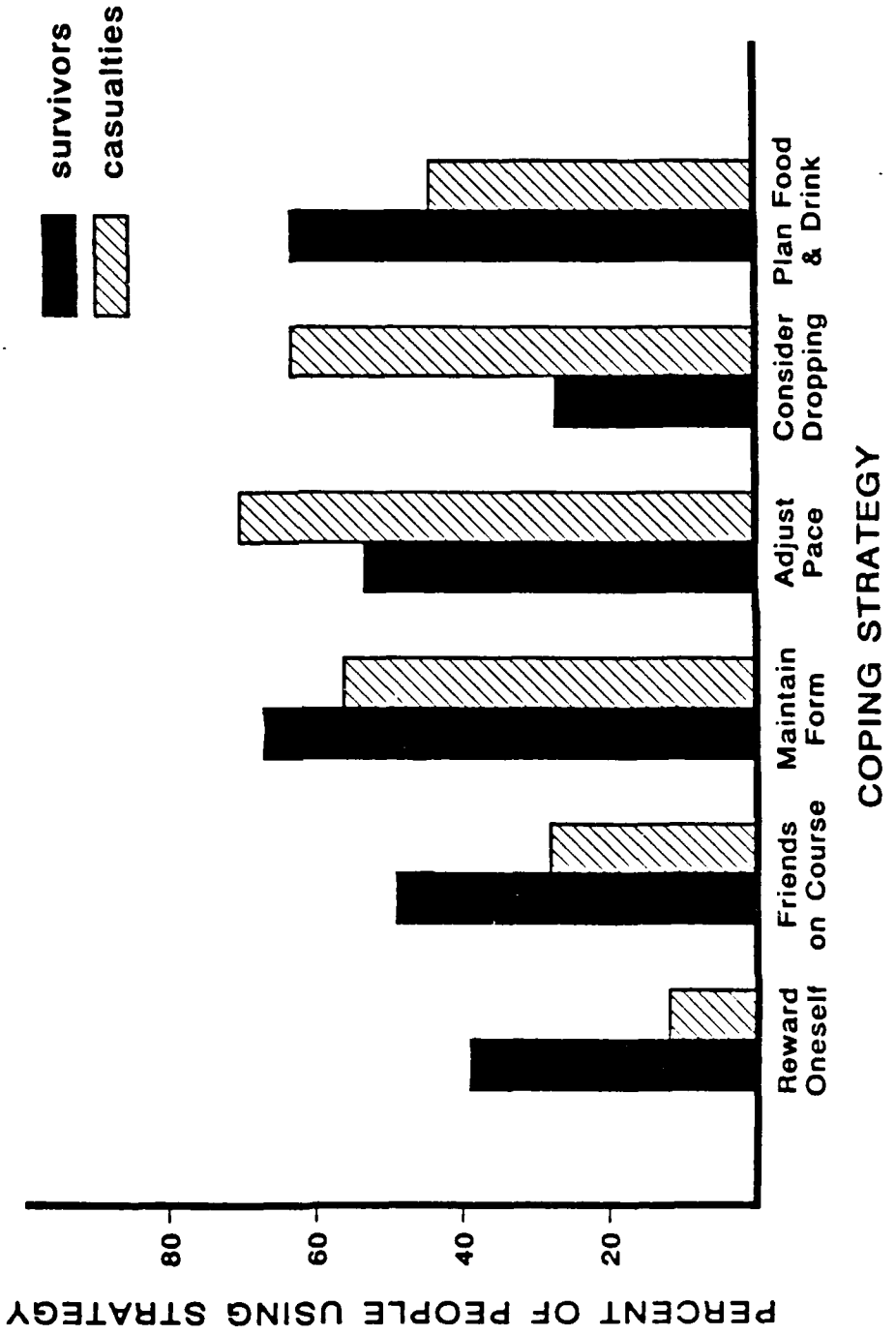


FIGURE 20

PERCENT OF PEOPLE BY GROUP THAT USED A PARTICULAR COPING STRATEGY (100-MILE)



Run-Time Prediction

A multiple regression analysis was performed to identify factors which best predict 50-mile ultramarathon finish time. Three factors: age, training pace and expected finishing time have been incorporated into the regression equation to predict finish time (R^2 = .95, F (3,5) = 31.82, $p < .001$). The regression equation is (Y = (Age * .081) + (Expected Finishing Time * .354) + training pace * 2.174) - 11.51. All other variables failed to meet the entry criterion associated with t ($p < .05$).

A multiple regression analysis was also performed on the 100-mile data to predict running time. Four variables; 1) expected running time, 2) training pace, and 3) hurts to breathe as well as 4) gas pressure before running have been incorporated into the regression equation to predict finish time (R^2 = .69, F (4,31) = 17.62, $p < .001$). The regression equation is (Y = (Expected Run Time * .937) - (Training Pace * .906) - (Hurts to Breathe * 6.626) - (Gas Pressure * 1.791) + 18.369).

A plot (not included) of standard residual errors vs. their respective X variable revealed the data was homoscedastic, i.e. that the variance was constant. The plot (not included) of the standard residuals vs. the predicted Y showed no pattern hence the goodness of fit of the model appears intact by the graphical test as well as the non-graphical tests of the F, t, and R^2 values. The plots of the predicted Y vs. the actual Y values for the 50 and 100 mile races respectively are illustrated in Figures 21 and 22 respectively. From Figure 21 it may be seen that there are two outliers which pull the regression line away from a close to perfect prediction R = .97.

FIGURE 21: REGRESSION OF PREDICTED RACE TIME vs ACTUAL RACE TIME (50-MILE)

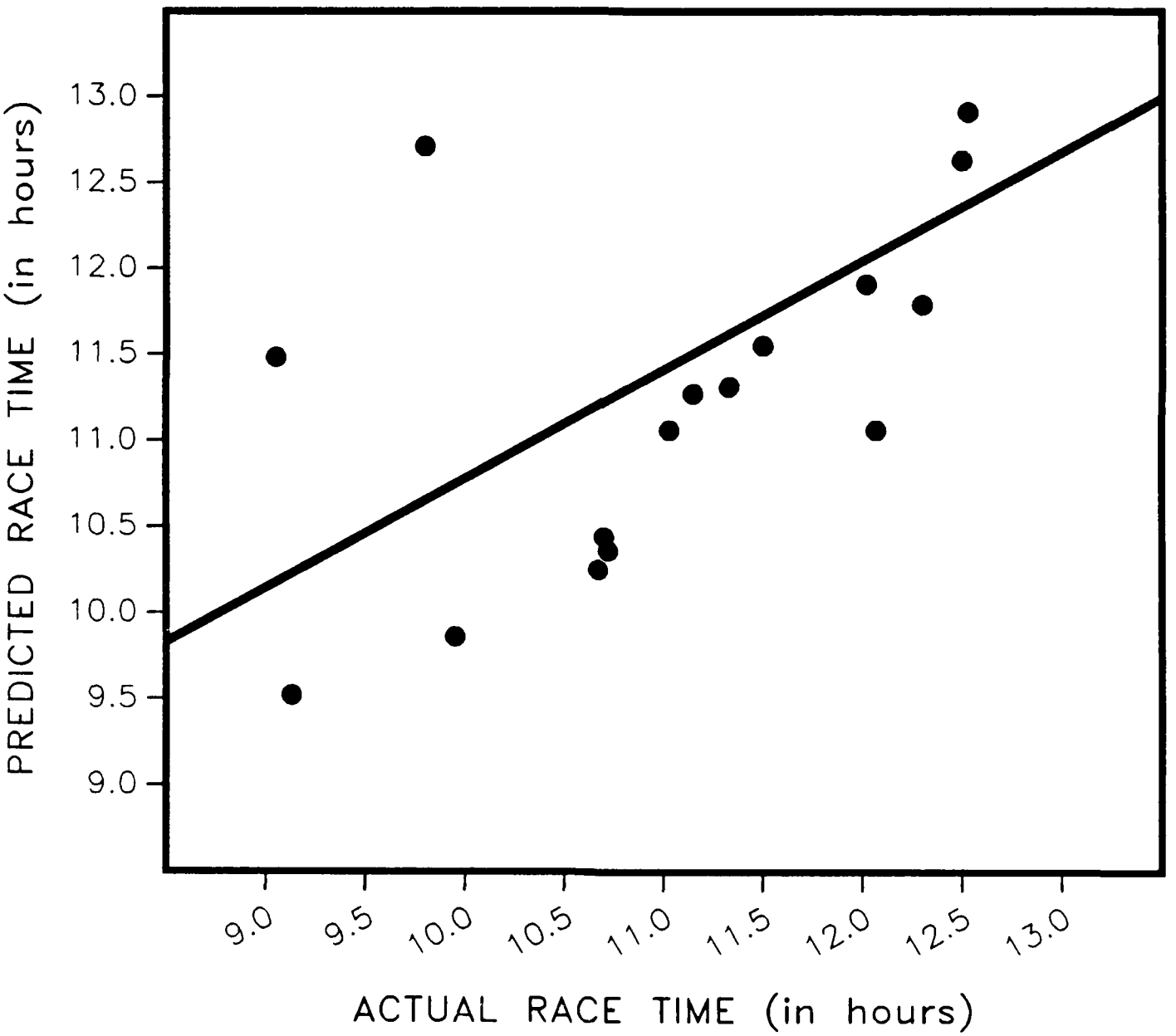
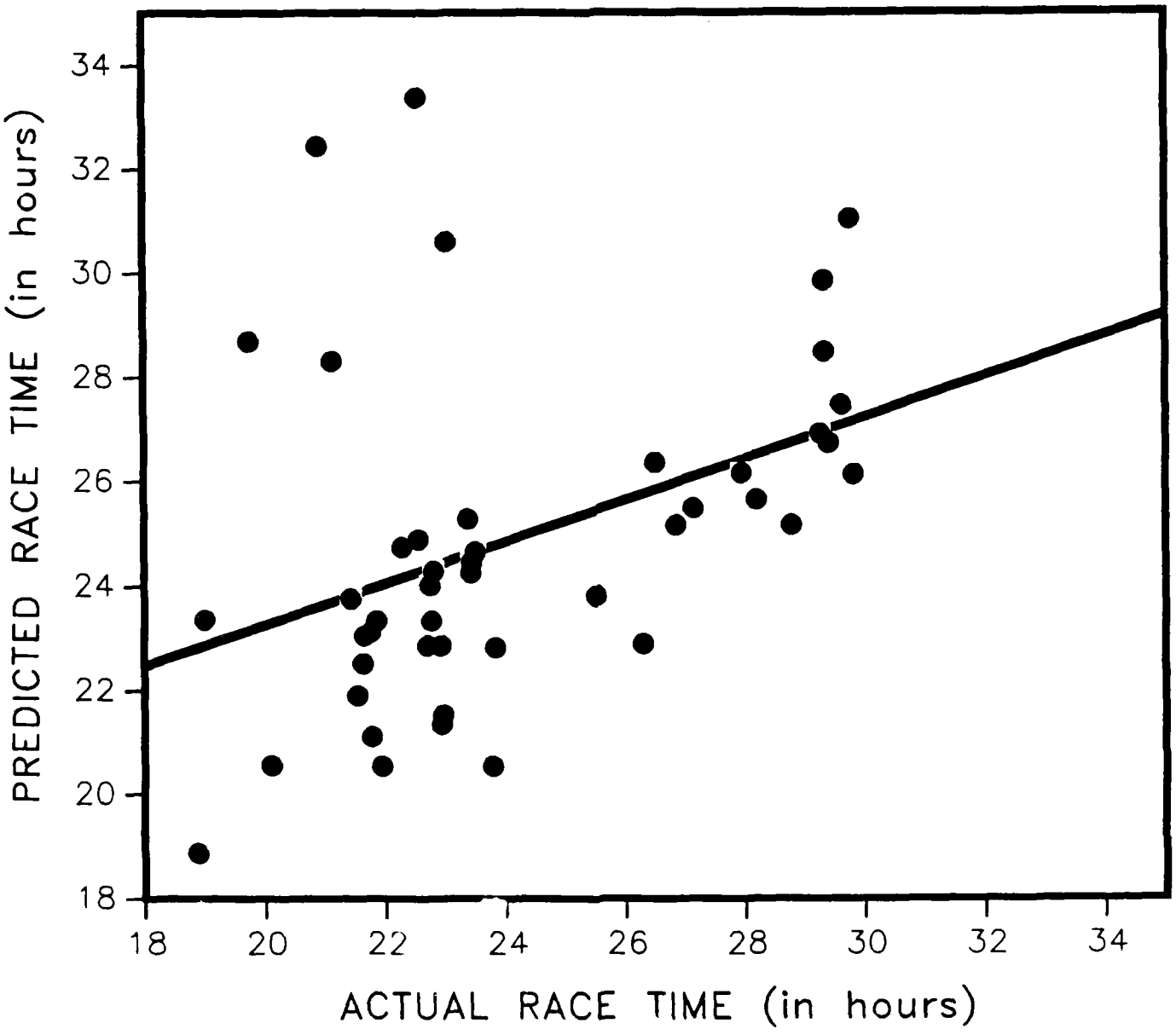


FIGURE 22: REGRESSION OF PREDICTED RACE TIME vs ACTUAL RACE TIME (100-MILE)



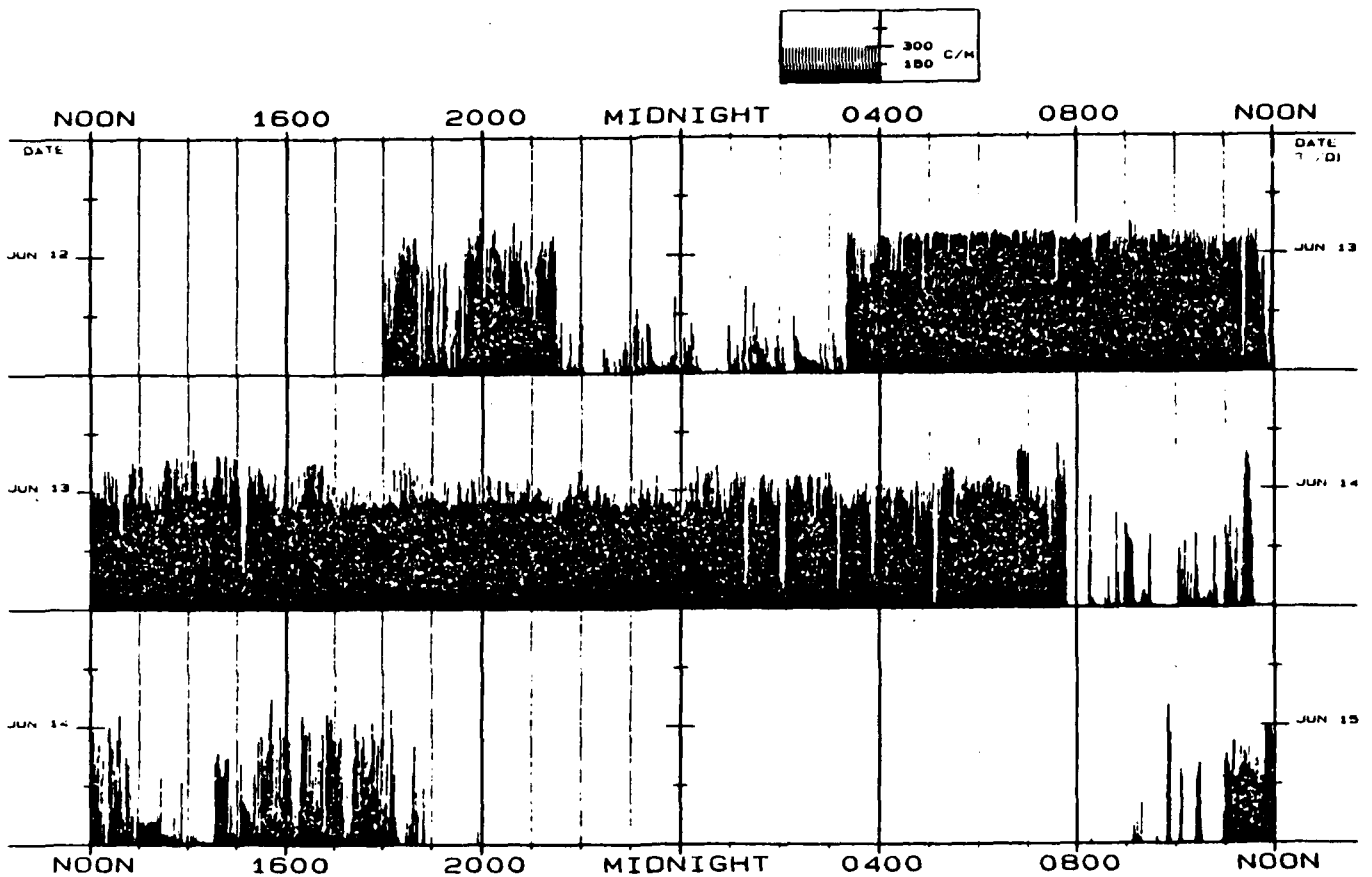
Activity Monitoring (Case Study)

Activity for the ultramarathon subject appears from the actigraph in Figure 23. The data represents limb activity beginning at 1800 hours on June 12 to 1230 hours on June 14th. He reported a restful sleep prior to the race on the night of June 12th. From the tracing there appears to be minimal physical activity over this time frame. The subject slept from 2130 hours June 12 to 0330 hours June 13th. The race began at 0400 hours June 13th. The subject was an accomplished well trained marathoner but was running in his first ultramarathon. For the first seven hours he reported to be running very comfortably. In fact he had a sizeable lead in the race. The tracing from the activity monitor (see Figure 23) exhibits a steady-state, i.e. very few peaks and valleys in the tracing. However at the 42-mile mark the subject became dehydrated and was reported to be feeling "very down, thirsty, hot and tired". Two dips in the tracing occur between 1100 hours and Noon. The first dip was where the subject reported "almost collapsing" and the second, a longer one approximately twenty minutes later, occurred at an aid station where he was able to replenish sugar and water losses as well as being administered cold wet towels to remove heat buildup.

Between noon and midnight on June 13th only one stop was recorded at a medical checkpoint just after 1500 hours. Weight loss (weight was down from 159 lbs to 152 lbs.) was recorded as well as receiving water, food, and a leg massage. The subject reported a shifting of highs and lows in his mental and physical state during this time frame. From Figure 23 changes in the patterns of physical activity may be observed during this portion of the race.

FIGURE 23

ACTIGRAPH RECORD OF ULTRAMARATHON RUNNER CASE STUDY OVER THE COURSE OF THE RACE

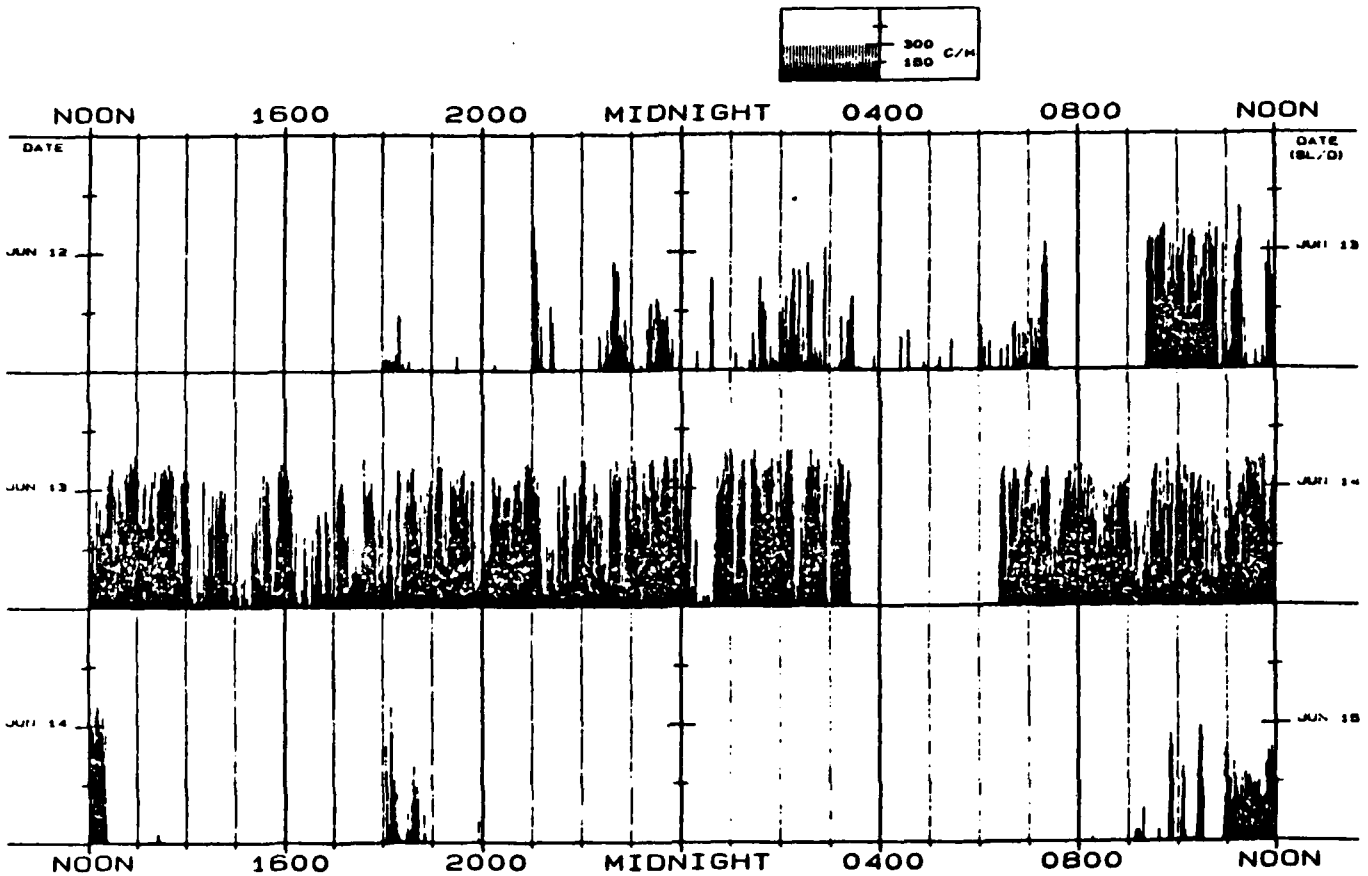


From midnight to approximately 0730 hours June 14th the subject stopped five times because of reported feelings of extreme fatigue and sleepiness. In general, his activity pattern had become more sporadic. This is not surprising, because under a state of fatigue a greater amount of work is required due to the inefficiency of one's motor unit recruitment to maintain the same performance output. This increased irregular muscular work output is characterized by the spikes in Figure 23. It must also be noted that from 0400 hours on, the subject was walking not running; yet at points the activity was as high as any other point in time. No circadian cycles were observed. The activity represents one's muscular effort which was sustained over the course of 27.5 hours but became sporadic in the final 7 hours probably due to inefficient motor unit recruitment and muscular co-contraction. The subject slept from 0800 hours to Noon on June 14th. The sleep was reported to be very restless and there was a considerable amount of physical activity. A muscle spasm was reported and may account for the 1100 hours spike.

A comparison may be seen between the subject who ran and a data collector who remained at an aid station (see Figure 24). The data collector, serving as a control, removed the activity monitor twice, once at 0730 hours to 0930 hours June 13 and again from 0330 to 0630 hours June 14. This control subject slept from 2130 June 12 to 0700 June 13 and again in the time period of 0330 to 0630 hours on June 14th (Activity monitor was off). A circadian cycle with a low at approximately 0030 hours June 14th may be observed.

FIGURE 24

ACTIGRAPH RECORD OF CONTROL SUBJECT CASE STUDY OVER THE COURSE OF THE RACE



DISCUSSION

Previous ultramarathon race experience for the 50-mile race showed significant differences between survivors and casualties with survivors having more race experience than did casualties. This corroborates the earlier findings by Rauch et al. (1988) which are also based on 50-mile race experience where a less experienced runner participated. In contrast are the findings for the 100-mile race where previous race experience does not differentiate significantly between survivors and casualties. This is in all likelihood due to the race entry requirements of having completed a previous ultramarathon to participate, although this requirement was waived for two runners within this study. The sample has pre-selected a higher caliber runner due to the difficulty of the race compared to the runner competing in the 50-mile race. Because the group of 100-mile runners are more homogenous, other factors must account for differences between survivors and casualties other than ultramarathon race experience.

Survivors in the 50-mile race appear to be in better physical condition. The survivors weighed less, had more years of competitive running, trained harder (more miles at a faster training pace) and raced in longer races than casualties. Within the 100-mile run the only differences observed between survivors and casualties were in mean body weight and best marathon time with survivors weighing less and having the better marathon time. Again it is apparent that within the 50-mile race some runners were entering the event not

as prepared physically for the challenges of running 50 miles. However, training factors do not appear to differentiate runners in the 100-mile race from being survivors or casualties. Perhaps an explanation for the 100-mile differences is poor racing strategy or an acute injury during the race (e.g. ankle sprain). Rauch et al. (1988), McCutcheon and Yoakum (1983) and Thompson, Nequin, Lesmes and Garfield (1982) all reported various positive relationships between training (i.e. miles run, training pace, etc.) and success in running an ultramarathon. The training information of the present study are consistent with these previous findings.

The mood changes experienced from prerun to postrun are similar to those reported from an earlier study (Tharion et al., 1988). The notable reduction in vigor along with the combined elevation of fatigue experienced postrun is in all likelihood due to the physiological stress imposed by running an ultramarathon. Although no measures of VO_2 max or the percentages of VO_2 max were attained in this particular event, Thompson, et al. (1982) reported that male ultramarathoners competing in a 50-mile race worked at an average of 72% of VO_2 max. It is not unreasonable to assume that the ultramarathoners in this study did not differ drastically.

Survivors experienced greater levels of fatigue than casualties upon the completion of the race. This coorborates earlier findings on postrun fatigue differences between survivors and casualties (Tharion et al., 1988). The most probable explanation is that survivors ran a greater distance and for a longer period of time than did casualties. A limitation of the study precluded examination of mood states during the course of the race without disturbing the integrity of the event. However, it would be interesting to examine mood

states at different points in time within the race. It may be hypothesized that at a given point in time when a casualty drops out, that the survivors would be experiencing less fatigue than his casualty counterpart at that point. Because the fatigue is of a particular intensity and there is still much of the task at hand left to complete, individuals may have felt they must withdraw because there is too far remaining to run the way they are feeling at that point in time. Although this is speculation, from interviews conducted with runners who turned out to be casualties, this is a realistic possibility.

Prior to the start of the race, subjects' mood profiles were similar to those observed in other athletes (Morgan, 1985) with one notable exception; tension levels were elevated, although still below what is reported for college students. The tension levels obtained were slightly higher than prerun values although comparable to those reported in a previous study examining mood changes involved in running an ultramarathon (Tharion et al., 1988). Upon completion of the 50-mile race, tension levels were reduced. The most probable cause, given the nature of the event, is that tension levels prior to the race were due to the uncertainties and possible fear of failure or injury associated with running the lengthy distance. To a lesser extent it may be that the exercise itself reduced tension levels as has been previously reported in numerous studies (Dishman, 1985; Lichtman & Poser, 1983; Markoff, Ryan & Young, 1982: Morgan, Horstman, Cymerman & Stokes, 1980; Bahrke & Morgan, 1978; Morgan & Horstman 1976; and Morgan, 1973).

The significant tension interaction effect noted in Figure 8 indicates that survivors tension levels decreased from pre to postrun, while casualties increased. These results indicate that the better runners were more uptight

about their upcoming performance perhaps because they placed more importance on it. These findings are in agreement with those of Hollandsworth and Jones (1979) who reported that the faster runners "reported themselves as more fearful and clutched up" before competing in a 20 kilometer race. Casualties increase in tension levels may be due to any injuries that forced withdrawl from the race or perhaps just an uneasyness about their unsuccessful performance.

Based upon the results from the 100-mile analysis, differences between survivors and casualties existed for depression, tension and vigor as well as for fatigue. The interaction effects demonstrate that survivor's levels of tension and depression remained relatively constant for depression and actually decreased for tension. Casualties on the other hand, had increased tension and depression scores. These findings may be explained by the failure to achieve one's goals (i.e. the successful running of the ultramarathon). Previous research has reported that failure to achieve personal goals may result in increased levels of frustration, anger and aggression (Ward & Eisler, 1987; Friedman & Ulmers, 1984; Bandura, 1977; and Berkowitz, 1962) especially in Type A individuals.

Mood profile had returned to the classic iceberg profile by one week for both the 100-mile and 50-mile runs. These changes are in agreement with those of Dyer and Crouch (1987) for tension and confusion over time. However, the present study found differences in vigor and fatigue and no changes in depression and anger, whereas Dyer and Crouch (1987) found changes with depression and anger and no changes in vigor and fatigue. Tension levels as well as all of the other mood scales in these administrations followed the

classic pattern described by Morgan (1985) in many other athletic groups. No interference of an upcoming race as was seen in the prerun administration influenced tension levels, hence these profiles are more representative of the individual's average mood profile.

Analyses of the postrun symptomatology showed the most intense symptoms focused on muscular fatigue and dehydration, especially in the 100-mile race. In the 100-mile race the ESQ symptom thirsty was the second most intense symptom reported next to feeling weak. It appears odd at first glance that sweating was not mentioned in conjunction with being thirsty. However, most finishers finished between 0100 and 0900 hours in the early morning when ambient temperatures were relatively cool (approximately 70 degrees fahrenheit). However, daytime temperatures reached 90 degrees and therefore in the previous twelve hours subjects lost a considerable amount of fluid which obviously was not completely replaced.

Another notable symptom present in the 100-mile race not present in the 50-mile race is the presence of gas pressure noted postrun. This may be accounted for in the 100-mile race because runners must eat as well as drink due to the length of the race. Some subjects may not be accustomed to eating while exercising intensely (most ultramarathoners only run at a maximum of two competitive ultramarathons a year). At the 50-mile race the event was completed by most of the runners in under thirteen hours. It is not unreasonable to eat very little over the course of a 50-mile race. However, it is almost imperative that the runners in the 100-mile run eat semi-regularly to avoid liver glycogen depletion (bonking).

The graphs of the interaction effects in the 50-mile race (Figures 11-15) illustrate survivors as being more symptomatic than are casualties immediately postrun. The results of the present study are similar to those reported in a previous study (Tharion et al., 1987). Figure 16 shows that survivors were much more restless before the start of the event (50-mile race) than casualties. This coincides with the tension feelings reported in Figure 6 of the POMS between 50-mile survivors and 50-mile casualties. Once the race was completed survivors and casualties both showed only slight signs of restlessness.

Finally, upon examination of Tables 11 and 12 it may be seen that no symptoms are present by one month postrun. At three months postrun, however, four symptoms appeared. This may be explained by the fact that subjects were probably training and racing again and these symptoms were totally unrelated to the ultramarathon under study. At one month post race subjects were just at the end of the recovery phase and were beginning to feel well again.

There were differences in the way successful vs. unsuccessful runners coped with the task of running an ultramarathon. An obvious difference between the groups may be found in the number of strategies that were reported to be helpful. Survivors reported significantly more of the strategies they used as having helped their performance. It is plausible that their positive attitude towards the use of coping strategies was instrumental in the survivor's ability to complete the race. Previous research supports the notion that belief in coping strategies enhances performance (Weinberg, Smith, Jackson, and Gould, 1984). Girodo and Wood (1973) found that positive self-talk while trying to cope with an aversive and painful task was instrumental when 1) the subject

believed in the effectiveness of positive coping statements and 2) the subject believed they did have personal control of the situation. The casualties' perceived ineffectiveness of a coping strategy may be due to a lack of confidence in the strategy and control over the strategy. Of course, a question that arises is, "did a particular outcome of the race affect one's evaluation of how well a strategy helped or not?" This is a very real possibility that cannot be discounted, but one that unfortunately was not controlled for.

Previous research has identified various types of coping strategies as being related to endurance events: association vs. dissociation (Morgan & Pollock, 1977), positive self-talk (Girodo & Roehl, 1978), and combinations of these approaches (Weinberg et al., 1984). Based upon this study, another type of general coping strategy is put forth post hoc: the partitioning of the event into segments. Strategies like planned breaks for food and drink and congratulated oneself after attaining intermediate goals are examples of strategies that partition the race into segments. Survivors were observed using these types of strategies to a greater extent than casualties. By breaking down the race into sections and racing each section as opposed to racing all 100 miles, the runner may be better able to cope with the stressors involved. Some preliminary work done with armor crews supports this finding. Munro et al. (1987) found that survivors work from task to task as opposed to dwelling on the length of the operation.

A much higher percentage of runners felt that the strategies they used helped in the 100-mile race compared to the 50-mile race. This may be accounted for by one of two explanations. First, runners in the 100-mile race

may have had the opportunity to utilize more strategies, and also to realize these strategies helped their performance, due to the time element of the race. Because the race is longer individuals may not have been as disappointed if they did not run the time they wanted or even finished because the challenge was much greater. For example, even though they became a casualty, they may have realized that a certain strategy helped them run 77 miles. The second possibility is more of a methodological one. It was emphasized to subjects in the 100-mile race more emphatically that even if their performance was not as successful as one hoped, it still should be considered helpful if it helped in achieving the given performance. The possible misinterpretation of the questionnaire was realized after preliminary analysis of the 50-mile race results which was conducted before the 100-mile race.

The results of the multiple regression analysis for both the 50 and the 100-mile races incorporate expected race time and training pace as important factors into their respective regression equations. This confirms the previous research findings by Rauch et al. (1988). Both equations predict with greater accuracy (50-mile, $\underline{R}^2$ = .95) and (100-mile, $\underline{R}^2$ = .69) than the earlier findings on 50-mile race performance $\underline{R}^2$ = .56 (Rauch et al., 1988). The 50-mile prediction of the present study also includes the runner's age in predicting race time.

It appears younger runners tend to run slightly faster than older runners. However, older runners appear to judge their abilities much better as they tend to run closer to their expected race time. Therefore, it appears that younger runners that do not run to their potential may have missed the mark because of poor strategy, whereas the older runners may have been slowed down because of physiological limitations.

The results from the present study confirm and expand upon those found in an earlier study, Tharion et al. (1987). It was observed that the changes in mood states and one's symptomatology had generally returned to baseline values by one week postrace. Secondly, survivors utilized about the same number of strategies casualties used; however survivors felt that the strategies they used were more instrumental in helping them achieve their performance than did casualties. It was also noted that survivors tended to pick strategies that help partition the race into smaller segments. Finally, new regression equations for both the 50 and 100-mile races were developed that explained 95 and 69 percent of the variance for the two races respectively. However, the equations are still utilizing very similar combinations with those equations developed earlier (Rauch et al., 1988 and Parrot et al., 1979).

The findings of the present study are of significance to the U.S. Army in that comparisons between the ultramarathon and a sustained military operation show many similarities. Sustained military operations require physical exertion for a prolonged period of up to 72 hours. Recommendations made to the ultrarunning community are also relevant to the military. Learning to manage stress, utilizing the most advantageous training techniques, and the employment of goal-setting strategies are important to enhance human performance.

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APPENDIX

TABLE A

Means and Standard Deviations Broken Down by Race (50 vs. 100-Mile) and by Analysis (2 vs. 5 Administrations).

	TENSION		DEPRESSION		ANGER	
	M	SD	M	SD	M	SD
50-Mile 5 Admin (N=15)						
Pre-Race	12.00	6.41	2.80	2.68	1.87	1.87
Post-Race	6.27	6.46	6.40	9.89	1.60	3.22
1 Week Post	5.27	4.08	3.07	4.77	2.40	3.24
1 Month Post	4.67	4.14	2.27	3.46	2.67	4.55
3 Months Post	4.47	3.35	2.40	3.69	1.93	3.52
50-Mile 2 Admin (N=36)						
Pre-Race	10.72	6.39	4.08	5.65	3.92	6.25
Post-Race	5.72	5.57	6.44	10.27	2.33	5.17
100-Mile 5 Admin (N=14)						
Pre-Race	12.64	4.60	4.07	6.08	3.38	6.39
Post-Race	9.00	6.63	5.79	6.25	5.14	7.72
1 Week Post	5.43	3.71	5.21	5.17	4.21	5.28
1 Month Post	5.71	4.21	3.50	6.53	2.57	3.51
3 Months Post	6.93	4.21	6.21	9.00	5.07	6.83
100-Mile 2 Admin (N=30)						
Pre-Race	12.23	4.73	3.83	4.98	3.50	5.68
Post-Race	9.80	6.23	8.30	9.49	5.73	7.59

TABLE A (cont.)

	VIGOR		FATIGUE		CONFUSION		TOTAL MOOD	
	M	SD	M	SD	M	SD	M	SD
50-Mile 5 Admin (N=15)								
Pre-Race	17.93	5.96	4.43	2.65	5.93	3.12	109.13	16.27
Post-Race	11.93	3.69	17.20	5.80	6.73	5.44	126.27	27.84
1 Week Post	17.40	6.98	5.40	5.74	4.20	3.94	102.93	25.48
1 Month Post	18.60	6.06	4.00	3.66	3.47	2.24	98.27	19.45
3 Months Post	19.93	6.96	5.48	2.73	3.47	2.73	98.27	20.42
50-Mile 2 Admin (N=36)								
Pre-Race	19.75	5.86	4.36	4.15	5.33	3.78	108.67	24.42
Post-Race	13.31	5.42	16.03	6.61	5.80	5.07	123.03	29.02
100-Mile 5 Admin (N=14)								
Pre-Race	21.71	5.70	5.07	4.83	4.50	3.54	107.93	24.90
Post-Race	12.07	4.49	17.93	8.40	6.29	4.47	132.07	29.74
1 Week Post	18.79	3.77	6.79	5.95	4.43	3.50	107.29	20.99
1 Month Post	20.21	5.50	7.14	5.89	4.43	3.95	103.14	22.45
3 Months Post	25.07	17.77	7.57	9.23	4.14	4.65	104.86	32.23
100-Mile 2 Admin (N=30)								
Pre-Race	20.80	6.30	5.77	5.12	4.80	3.54	109.33	23.83
Post-Race	10.20	5.13	18.60	6.93	8.27	5.42	140.50	31.69

Table B

Significant Differences by Analysis and Race for the Profile of Mood States

Analysis	MOOD FACTOR	SOURCE	DF	F	SIG
50-Mile (5 Admins.)	Tension	Administration	(4,52)	6.60	.001
	Vigor	Administration	(4,52)	6.58	.001
	Fatigue	Administration	(4,52)	25.80	.001
	Confusion	Administration	(4,52)	2.93	.05
	Total Mood	Administration	(4,52)	5.04	.01

*No significant effects existed for either Group or the interaction of Group X Administration.

50-Mile (2 Admins.)	Tension	Administration	(1,34)	21.99	.001
	Vigor	Administration	(1,34)	27.74	.001
	Fatigue	Administration	(1,34)	86.61	.001
	Total Mood	Administration	(1,34)	8.48	.01
	Fatigue	Group	(1,34)	3.03	.09
	Fatigue	AG	(1,34)	6.60	.01
100-Mile (5 Admins.)	Tension	Administration	(4,48)	3.42	.02
	Vigor	Administration	(4,48)	3.01	.03
	Fatigue	Administration	(4,48)	4.44	.01
	Total Mood	Administration	(4,48)	3.01	.03

*No significant effects existed for either Group or the interaction of Group X Administration.

100-Mile (2 Admins.)	Depression	Administration	(1,28)	9.61	.01
	Vigor	Administration	(1,28)	63.74	.001
	Fatigue	Administration	(1,28)	43.34	.001
	Confusion	Administration	(1,28)	43.39	.001
	Total Mood	Administration	(1,28)	25.38	.001
	Depression	Group	(1,28)	4.19	.05
	Vigor	Group	(1,28)	3.85	.05
	Tension	AG	(1,28)	5.46	.03
	Depression	AG	(1,28)	3.50	.07
	Fatigue	AG	(1,28)	3.00	.09

Table C

Symptom Intensity Means by Administration and Level of Significant Difference by Administration (50-Mile)

	Pre-Race	Post-Race	1-Week Post	1-Month Post	3-Month Post	Admin F	Admin P
Short of Breath	0.07	1.27	0.00	0.00	0.20	12.48	0.0001
Hard to Breathe	0.00	1.20	0.00	0.00	0.13	10.47	0.0001
Hurts to Breathe	0.00	0.67	0.00	0.00	0.00	4.74	0.01
Muscle Cramps	0.13	1.67	0.27	0.13	0.07	12.95	0.0001
Stomach Cramps	0.33	0.87	0.07	0.00	0.07	3.37	0.02
Muscles Tight	0.47	2.87	1.27	0.33	1.07	17.77	0.0001
Feel Weak	0.33	2.00	1.07	0.27	0.53	8.01	0.0001
Legs, Feet Hurt	0.00	3.73	0.73	0.73	0.47	33.87	0.0001
Upper Body Aches	0.00	1.53	0.33	0.33	0.47	7.63	0.0001
Back Aches	0.40	1.87	0.40	0.40	0.33	9.08	0.0001
Stomach Aches	0.47	0.40	0.07	0.00	0.13	2.28	NS
Feel Light Headed	0.13	1.00	0.33	0.00	0.00	5.31	0.01
Have Headache	0.20	0.73	0.33	0.00	0.07	2.79	0.04
Feel Dizzy	0.07	0.80	0.27	0.00	0.00	3.60	0.02
Feel Faint	0.00	0.67	0.27	0.00	0.00	2.85	0.04
Vision Dim	0.07	0.27	0.20	0.00	0.00	1.12	NS
Coordination Off	0.07	1.40	0.27	0.07	0.07	13.29	0.0001
Stick To St.nach	0.33	1.20	0.27	0.00	0.00	4.81	0.01
Gas Pressure	0.67	0.47	0.33	0.13	0.40	.80	NS
Feel Warm	0.40	0.73	0.93	0.80	1.00	.99	NS
Feel Sweaty	0.21	0.57	0.07	0.14	0.57	2.74	0.04
Sweaty All Over	0.00	0.53	0.07	0.20	0.47	1.71	NS
Body Parts Numb	0.07	0.80	0.00	0.00	0.00	6.91	0.001
Eyes Irritated	0.40	0.73	0.40	0.47	0.47	.81	NS
‹ose Stuffed Up	0.20	0.27	0.60	0.47	0.20	1.55	NS
Nose Bleeds	0.00	0.07	0.07	0.00	0.00	.76	NS
Mouth Dry	0.47	1.00	0.27	0.13	0.13	3.46	0.02
Lost Appetite	0.47	1.53	0.27	0.07	0.13	5.43	0.01
Feel Sick	0.40	1.07	0.27	0.13	0.00	4.91	0.01
Feel Hungover	0.07	0.13	0.33	0.00	0.00	1.30	NS
Thirsty	0.27	1.40	0.67	0.53	0.40	6.36	0.01
Feel Tired	1.07	3.60	1.40	0.80	1.20	15.64	0.0001
Feel Sleepy	1.20	1.53	0.87	0.53	0.93	1.51	NS
Couldn't Sleep Well	1.07	0.73	0.93	0.33	1.20	1.04	NS
Concentration Off	0.33	1.20	0.47	0.07	0.40	5.31	0.01
Feel Irritable	0.33	0.27	0.60	0.20	0.20	1.47	NS
Feel Restless	1.27	0.40	0.53	0.47	0.40	5.33	0.01
Bored	0.07	0.20	0.87	0.33	0.73	2.52	NS
Feel Depressed	0.07	0.33	0.60	0.20	0.53	1.55	NS
Feel Alert	3.13	1.93	2.47	3.40	3.13	4.07	0.01
Feel Good	3.40	2.87	3.13	3.80	3.27	1.45	NS

Table D

Symptom Intensity Means For Survivors and Casualties by Administration and Level of Significant Difference by Group (50-Mile)

	Pre-Race		Post-Race		1-Week Post		1-Month Post		3-Month Post		Group	
	Sur	Cas	Sur	Cas	Sur	Cas	Sur	Cas	Sur	Cas	F	P
Short of Breath	0.00	0.13	1.43	1.13	0.00	0.00	0.00	0.00	0.14	0.25	0.01	NS
Hard to Breathe	0.00	0.00	1.57	0.88	0.00	0.00	0.00	0.00	0.14	0.13	0.97	NS
Hurts to Breathe	0.00	0.00	0.86	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.33	NS
Muscle Cramps	0.14	0.13	2.71	0.75	0.43	0.13	0.29	0.00	0.00	0.13	5.13	.05
Stomach Cramps	0.29	0.38	1.14	0.63	0.14	0.00	0.00	0.00	0.14	0.00	0.45	NS
Muscles Feel Tight	0.57	0.38	4.14	1.75	1.43	1.13	0.43	0.25	1.71	0.50	7.46	.02
Feel Weak	0.57	0.13	2.71	1.38	1.57	0.63	0.43	0.13	0.57	0.50	4.41	NS
Legs or Feet Ache	0.14	0.50	4.43	3.13	0.57	0.88	0.57	0.88	0.71	0.25	0.36	NS
Upper Body Aches	0.00	0.00	2.00	1.13	0.29	0.38	0.14	0.13	0.43	0.50	0.36	NS
Back Aches	0.14	0.63	2.71	0.75	0.43	0.38	0.14	0.63	0.43	0.25	0.75	NS
Stomach Ache	0.57	0.38	0.43	0.38	0.14	0.00	0.00	0.00	0.14	0.13	0.24	NS
Feel Light Headed	0.14	0.13	1.14	0.88	0.71	0.00	0.00	0.00	0 00	0.00	0.66	NS
Have a Headache	0.29	0.13	0.86	0.63	0.57	0.13	0.00	0.00	0.00	0.13	0.60	NS
Feel Dizzy	0.14	0.00	1.14	0.50	0.57	0.00	0.00	0.00	0.00	0.00	1.34	NS
Feel Faint	0.00	0.00	0.86	0.50	0.57	0.00	0.00	0.00	0.00	0.00	0.58	NS
Vision is Dim	0.14	0.00	0.29	0.25	0.43	0.00	0.00	0.00	0.00	0.00	0.73	NS
Coordination is Off	0.14	0.00	2.14	0.75	0.43	0.13	0.14	0.00	0.14	0.00	5.11	.05
Sick to Stomach	0.29	0.38	1.29	1.13	0.57	0.00	0.00	0.00	0.00	0.00	0.18	NS
Gas Pressure	1.00	0.38	0.71	0.25	0.14	0.50	0.29	0.00	0.29	0.50	0.54	NS
Feel Warm	0.57	0.25	0.71	0.75	1.14	0.75	1.00	0.63	0.86	1.13	0.14	NS
Feet Are Sweaty	0.17	0.25	1.00	0.25	0.17	0.00	0.17	0.13	0.50	0.63	0.31	NS
Sweaty All Over	0.00	0.00	0.71	0.38	0.14	0.00	0.29	0.13	0.71	0.25	1.14	NS
Body Parts Are Numb	0.14	0.00	1.14	0.50	0.00	0.00	0.00	0.00	0.00	0.00	1.18	NS
Eyes Irritated	0.57	0.25	1.00	0.50	0.86	0.00	0.57	0.38	0.43	0.50	2.48	NS
Nose Stuffed Up	0.43	0.00	0.43	0.13	0.57	0.63	0.29	0.63	0.29	0.13	0.13	NS
Nose Bleeds	0.00	0.00	0.00	0.13	0.14	0.00	0.00	0.00	0.00	0.00	0.01	NS
Mouth Dry	1.00	0.00	1.29	0.75	0.57	0.00	0.14	0.13	0.00	0.25	4.89	.05
Lost Appetite	1.00	0.00	2.00	1.13	0.57	0.00	0.14	0.00	0.29	0.00	3.68	NS
Feel Sick	0.57	0.25	1.43	0.75	0.57	0.00	0.29	0.00	0.00	0.00	1.22	NS
Feel Hungover	0.14	0.00	0.14	0.13	0.71	0.00	0.00	0.00	0.00	0.00	2.50	NS
Thirsty	0.43	0.13	2.29	0.63	1.00	0.38	0.43	0.63	0.29	0.50	2.84	NS
Feel Tired	0.86	1.25	4.43	2.88	1.71	1.13	1.00	0.63	1.29	1.13	1.99	NS
Feel Sleepy	1.14	1.25	1.71	1.38	0.86	0.88	0.71	0.38	1.00	0.88	0.14	NS
Couldn't Sleep Well	1.57	0.63	1.00	0.50	1.71	0.25	0.71	0.00	1.29	1.13	3.96	NS
Concentration is Off	0.57	0.13	1.86	0.63	0.57	0.38	0.14	0.00	0.29	0.50	2.41	NS
Feel Irritable	0.71	0.00	0.43	0.13	0.86	0.38	0.43	0.00	0.14	0.25	2.81	NS
Feel Restless	2.00	0.63	0.43	0.38	0.71	0.38	0.71	0.25	0.29	0.50	2.61	NS
Bored	0.14	0.00	0.14	0.25	1.14	0.63	0.43	0.25	0.71	0.75	0.21	NS
Feel Depressed	0.14	0.00	0.00	0.63	0.71	0.50	0.43	0.00	0.71	0.38	0.15	NS
Feel Alert	2.71	3.50	1.86	2.00	2.43	2.50	3.29	3.50	3.29	3.00	0.15	NS
Feel Good	3.14	3.63	3.57	2.25	3.14	3.13	3.71	3.88	3.00	3.50	0.01	NS

Table E

Symptom Intensity Means by Administration and Level of Significant Difference by Administration (100-Mile)

	Pre-Race	Post-Race	1-Week Post	1-Month Post	3-Month Post	Admin F	Admin P
Short of Breath	0.00	0.75	0.19	0.08	0.19	3.28	0.02
Hard to Breathe	0.00	0.31	0.00	0.00	0.00	4.95	0.002
Hurts to Breathe	0.13	2.69	0.69	0.25	0.25	14.25	0.0001
Muscle Cramps	0.38	3.69	1.44	0.69	1.25	22.08	0.0001
Stomach Cramps	0.19	1.56	0.19	0.00	0.19	6.47	0.0002
Muscles Tight	0.56	2.75	0.69	0.69	0.69	9.96	0.0001
Feel Weak	0.56	3.94	1.69	0.75	1.00	16.87	0.0001
Legs, Feet Hurt	0.06	1.88	0.38	0.56	0.56	6.48	0.0002
Upper Body Aches	0.19	1.56	0.44	0.38	0.50	3.66	0.01
Back Aches	0.50	1.56	0.13	0.13	0.06	5.95	0.0005
Stomach Aches	0.13	1.38	0.13	0.13	0.19	5.89	0.0005
Feel Light Headed	0.25	0.31	0.06	0.00	0.06	.65	NS
Have Headache	0.06	0.88	0.25	0.06	0.06	2.84	0.03
Feel Dizzy	0.06	0.88	0.25	0.06	0.06	3.13	0.02
Feel Faint	0.06	0.56	0.25	0.06	0.13	1.99	NS
Vision Dim	0.06	1.75	1.35	0.06	0.31	10.87	0.0001
Coordination Off	0.19	1.75	0.13	0.06	0.19	7.38	0.0001
Stick To Stomach	0.31	0.69	0.25	0.06	0.62	1.40	NS
Gas Pressure	0.50	2.13	0.44	0.56	0.56	7.20	0.0001
Feel Warm	0.25	1.31	0.25	0.19	0.50	3.67	0.01
Feel Sweaty	0.06	1.25	0.25	0.06	0.38	3.38	0.02
Sweaty All Over	0.00	0.88	0.44	0.13	0.19	2.37	NS
Body Parts Numb	0.31	1.31	0.68	0.38	0.63	3.24	0.02
Eyes Irritated	0.56	0.38	0.44	0.44	0.81	1.62	NS
Nose Stuffed Up	0.25	1.13	0.25	0.19	0.13	2.31	NS
Nose Bleeds	0.00	0.00	0.00	0.00	0.00	0.00	NS
Mouth Dry	0.18	2.13	0.18	0.13	0.31	8.47	0.0001
Lost Appetite	0.13	1.94	0.19	0.06	0.31	7.98	0.0001
Feel Sick	0.06	0.75	0.19	0.00	0.18	3.86	0.01
Feel Hungover	0.69	1.37	0.44	0.44	1.00	2.17	NS
Thirsty	0.50	3.88	0.88	0.75	1.19	26.04	0.0001
Feel Tired	1.07	3.15	1.45	0.80	0.40	18.64	0.0001
Feel Sleepy	0.25	3.00	0.68	0.50	0.62	26.19	0.0001
Couldn't Sleep Well	0.44	2.25	1.13	0.50	0.68	10.28	0.0001
Concentration Off	0.19	1.44	0.81	0.38	0.44	5.94	0.0005
Feel Irritable	0.13	0.69	0.50	0.19	0.50	2.05	NS
Feel Restless	0.50	1.00	0.75	0.56	0.44	2.71	0.04
Bored	0.31	0.18	0.81	0.69	0.44	2.46	NS
Feel Depressed	0.06	0.50	0.68	0.25	0.50	1.80	NS
Feel Alert	2.81	1.75	3.19	3.31	3.38	4.20	0.005
Feel Good	3.50	1.87	3.44	3.69	4.06	7.81	0.0001

Table F

Symptom Intensity Means For Survivors and Casualties by Administration and Level of Significant Difference by Group (100-Mile)

	Pre-Race		Post-Race		1-Week Post		1-Month Post		3-Month Post		Group	
	Sur	Cas	Sur	Cas	Sur	Cas	Sur	Cas	Sur	Cas	F	P
Short of Breath	0.00	0.00	0.64	1.00	0.00	0.60	0.09	0.00	0.00	0.60	2.98	NS
Hard to Breathe	0.00	0.00	0.09	0.80	0.00	0.00	0.00	0.00	0.00	0.00	3.14	NS
Hurts to Breathe	0.27	0.00	2.73	2.60	0.82	0.40	0.18	0.40	0.18	0.40	.03	NS
Muscle Cramps	0.54	0.00	3.73	3.60	1.54	1.40	0.73	0.60	1.27	1.20	.23	NS
Stomach Cramps	0.27	0.00	1.45	1.80	0.09	0.40	0.00	0.00	0.09	0.40	.50	NS
Muscles Feel Tight	0.54	0.60	2.82	2.60	0.64	0.80	0.36	1.00	0.73	0.60	.08	NS
Feel Weak	0.45	0.20	3.91	4.00	1.73	1.60	0.45	1.40	1.00	1.00	.13	NS
Legs or Feet Ache	0.09	0.00	1.82	2.00	0.27	0.60	0.64	0.40	0.55	0.60	.03	NS
Upper Body Aches	0.18	0.20	1.55	1.60	0.36	0.60	0.27	0.60	0.63	0.20	.02	NS
Back Aches	0.73	0.00	1.36	2.00	0.00	0.40	0.09	0.20	0.09	0.00	.05	NS
Stomach Ache	0.18	0.00	1.27	1.60	0.09	0.60	0.09	0.20	0.09	0.40	.91	NS
Feel Light Headed	0.36	0.00	0.36	0.20	0.09	0.00	0.00	0.00	0.00	0.60	0.00	NS
Have a Headache	0.09	0.00	0.82	1.00	0.09	0.60	0.00	0.20	0.00	0.20	1.34	NS
Feel Dizzy	0.09	0.00	0.82	1.00	0.09	0.60	0.00	0.20	0.00	0.20	1.50	NS
Feel Faint	0.09	0.00	0.36	1.00	0.09	0.60	0.09	0.00	0.00	0.40	2.75	NS
Vision is Dim	0.09	0.00	0.64	2.00	0.27	0.60	0.00	0.20	0.27	0.40	.88	NS
Coordination is Off	0.27	0.00	0.73	0.80	0.00	0.40	0.00	0.20	0.09	0.40	.35	NS
Sick to Stomach	0.36	0.20	0.91	0.20	0.18	0.40	0.09	0.00	0.45	1.00	.03	NS
Gas Pressure	0.64	0.20	2.18	2.00	0.27	0.80	0.55	0.60	0.45	0.80	.03	NS
Feel Warm	0.27	0.20	1.18	1.60	0.09	0.60	0.18	0.20	0.36	0.80	.68	NS
Feet Are Sweaty	0.09	0.00	1.18	1.40	0.09	0.60	0.09	0.00	0.27	0.60	.44	NS
Sweaty All Over	0.00	0.00	0.73	1.10	0.45	0.40	0.09	0.20	0.09	0.40	.59	NS
Body Parts Are Numb	0.36	0.20	1.09	0.80	0.45	1.10	0.36	0.40	0.30	1.10	2.58	NS
Eyes Irritated	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	.07	NS
Nose Stuffed Up	0.27	0.20	1.10	1.10	0.18	0.40	0.18	0.20	0.00	0.40	.31	NS
Nose Bleeds	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	2.41	NS
Mouth Dry	0.27	0.00	2.36	1.60	0.00	0.60	0.09	0.20	0.18	0.60	0.00	.NS
Lost Appetite	0.18	0.00	2.00	1.80	0.00	0.60	0.00	0.20	0.18	0.60	.37	NS
Feel Sick	0.09	0.00	0.36	1.60	0.27	0.00	0.00	0.00	0.00	0.60	3.60	NS
Feel Hungover	0.72	0.60	1.36	1.40	0.45	0.40	0.36	0.60	0.60	0.64	1.80	NS
Thirsty	0.55	0.40	3.91	3.80	0.82	1.00	0.64	1.00	1.00	1.60	.43	NS
Feel Tired	0.55	0.40	3.90	4.00	0.82	0.70	0.84	0.70	1.29	1.13	1.87	NS
Feel Sleepy	0.36	0.00	2.55	4.00	0.55	1.00	0.45	0.60	0.45	1.00	2.23	NS
Couldn't Sleep Well	0.63	0.00	1.82	3.20	1.00	1.40	0.63	0.20	0.63	0.80	.16	NS
Concentration is Off	0.27	0.00	1.18	2.00	0.82	0.80	0.36	0.40	0.36	0.60	.27	NS
Feel Irritable	0.09	0.20	0.45	1.20	0.45	0.60	0.18	0.20	0.55	0.40	.32	NS
Feel Restless	0.63	0.20	0.63	1.80	0.63	1.00	0.55	0.60	0.45	0.40	.50	NS
Bored	0.27	0.40	0.27	0.00	0.73	1.00	0.73	0.60	0.36	0.60	.02	NS
Feel Depressed	0.09	0.00	0.27	1.00	0.45	1.20	0.09	0.60	0.45	0.60	3.13	NS
Feel Alert	2.91	2.60	2.90	2.40	3.27	3.00	3.27	3.40	3.64	3.80	.47	NS
Feel Good	3.45	3.60	2.18	1.20	3.36	3.60	3.73	3.60	4.09	4.00	.09	NS

TABLE G

Frequency of Survivors and Casualties Use of Coping Strategies and Whether They Felt it Helped Their Performance for the 50 and 100 Mile Races

Strategy	50-MILE				100-MILE			
	Survivors		Casualties		Survivors		Casualties	
	Use	Help	Use	Help	Use	Help	Use	Help
New Train Strategy	8	1	14	2	9	9	7	3
Carbo-Load	11	0	17	4	13	13	6	4
Simulated Race	7	1	7	1	9	7	5	2
Run Related Activ.	6	1	9	3	7	6	2	1
Muscle Relaxation	11	1	9	4	4	4	2	1
Meditation	4	2	3	1	3	2	1	0
Pos. Mental Imag.	20	5	17	9	14	11	7	2
Neg. Mental Imag.	2	0	7	5	4	2	3	0
Multiple Goals	17	2	20	7	18	16	8	4
External Cause	6	1	4	1	6	5	2	0
Taper for Race	13	1	15	9	17	16	9	4
Superstitions	3	0	2	2	3	1	1	0
Deal With Self	2	0	3	2	2	2	2	0
Self Reward	11	2	11	2	9	8	3	1
Ran With Others	17	2	21	1	19	17	10	10
Bodily Functions	16	2	19	6	10	6	5	4
Focused on Pain	0	0	2	0	1	1	2	0
Ignore the Pain	15	3	20	6	13	10	8	7
Repeat a Mantra	1	0	1	1	2	1	2	1
Keep Smile on Face	15	3	19	3	8	4	5	4
Friends on Course	11	3	7	0	14	12	5	4
Pleasant Thoughts	12	3	12	3	8	8	4	1
Sang Songs	10	3	6	1	4	2	3	0
Maintain Form	21	2	17	4	13	13	7	1
Adjust Race Pace	14	2	21	6	13	12	9	1
Thought of God	4	0	8	3	9	8	2	2
Self-Talk	13	3	14	2	12	11	8	6
Consider Dropping	8	6	18	12	6	3	9	9
Food/Drink Breaks	16	4	15	3	16	16	4	3

* To have a particular strategy thought of as helping, the runner must have used it.

** Number of subjects in the groups are as follows:

50-MILE	Survivors	N = 27
	Casualties	N = 32
100-Mile	Survivors	N = 24
	Casualties	N = 11

TABLE H

Mean Number Used and Helped for Coping Strategies
for 100-Mile Run for Results Which are Significant

	SURVIVORS			CASUALTIES		
	Used	Helped	Percent	Used	Helped	Percent
Total Strategies (29)	11.1	10.2	92%	12.8	6.7	52%
Pre-Race Strategies (13)	4.5	4.2	92%	5.0	1.9	38%
Psychological Strategies (11)	2.7	2.5	94%	3.2	1.1	34%
Training Strategies (8)	3.7	3.3	89%	4.7	2.0	42%
Dietary Strategies (2)	1.2	1.2	100%	.9	.6	70%

* Percent is number helped over number used
** Numbers in parentheses are total strategies possible

TABLE I

Rank Order of Coping Strategies by Survivor/Casualty
by Percentage of the Group Using that Strategy

SURVIVORS		CASUALTIES	
Strategy	%	Strategy	%
Ran with others intentionally	71	Ran with others intenti ally	72
Set multiple goals	69	Constantly adjusted race pace	70
Used positive mental imagery	67	Set multiple goals	68
Focused on maintaining run form	67	Tried to ignore pain	65
Had planned food and drink breaks	63	Considered dropping out of race	63
Tapered for race	59	Used positive mental imagery	59
Tried to ignore pain	55	Did carbohydrate loading	56
Constantly adjusted race pace	53	Tapered for race	56
Focused on body functions	51	Focused on body functions	56
Had friends and family on course	49	Tried to keep smile on face	56
Verbally self-talked to one-self	49	Focused on maintaining run form	56
Did carbohydrate loading	47	Verbally self-talked to oneself	51
Tried to keep a smile on face	45	Tried new training techniques	49
Thought of non-race things	39	Had planned food and drink breaks	44
Reward after achieving IM goals	39	Thought of non-race things	37
Tried new training techniques	33	Ran a simulated or training race	28
Ran a simulated or training race	31	Had friends and family on course	28
Used muscle relaxation techniques	29	Non-physical run related things	27
Considered dropping out of race	27	Used muscle relaxation techniques	26
Sang songs to oneself	27	Used negative mental imagery	23
Thought of God (said prayers)	25	Thought of God (said prayers)	23
Non-physical run related things	25	Sang songs to oneself	21
Ran for an external cause	24	Ran for an external cause	14
Used meditation	14	Reward after achieving IM goals	12
Practiced pre-race superstitions	12	Made a deal with oneself	12
Used negative mental imagery	12	Used meditation	9
Made a deal with oneself	8	Focused on the pain	9
Repeated a mantra	6	Repeated a mantra	7
Focused on the pain	2	Practiced pre-race superstitions	7

TABLE J

US Army Research Institute of Environmental Medicine
Health and Performance Division

DEMOGRAPHICS

Directions: Please answer each question in the space provided.

1. Name_____ 2. Age_____

3. Sex_____ 4. Do You Smoke?_____

5. Race

A. Caucasion_____
B. Black _____
C. Hispanic _____
D. Asian _____
E. Other _____

6. Education Level

A. Less than H.S. Diploma_____
B. H.S. Diploma _____
C. Some College _____
D. Undergrad _____
E. Master's Degree _____
F. Ph.D. _____

7. Height_____ 8. Weight_____

9. Percent Body Fat (If Known)_____

10. Home (City and State)_____

11. How Long Have You Been Competitively Running?_____(yrs.)

12. What Is The Longest Running Race You Have Completed?_____(miles:kms.)

13. Approximate Number of Ultra Races Entered Previously?

A. None _____
B. One _____
C. 2 to 5 _____
D. 5 to 10 _____
E. More than 10 _____

14. What Time Do You Realistically Expect To Run Based On Your Training?

_____ (Hours:Mins)

15. Number Of Weeks Seriously Trained _____ (wks)

16. Average Number Of Miles/Week Trained _____ (miles/week)

17. Average Min/Mile Training Pace Used In Training _____ (min/mile)

18. Longest Single Training Run _____.

19. Best Performance In Last Two Years: 10K _____ (min:sec)

Marathon_____ (hours:min)

The next section is to ascertain runner's goals. The goals many runners express seem to vary depending on the actual race conditions and how one feels at the time of the race. The next three questions are designed to get at these goals. (For example in a marathon, one's ultimate goal may be to break 3 hours. However, with a personal record of 3:30 this runner's primary goal is to set a PR. Finally, above all else he/she wants to finish the race.)

18. If The Conditions And Every Aspect Of Your Race Goes Perfectly What Is The Highest Goal You Hope To Attain?

    A. A Specific Time — What Is That Time?
    B. A Specific Place — What Is That Place?
    C. To Finish
    D. Other — Please Elaborate On This Choice Or Any Others.

19. If The Conditions Are Not Optimum What Is The Minimum Level Of Performance That Will Allow You To Still Be Satisfied?

    A. A Specific Time — What Is That Time?
    B. A Specific Place — What Is That Place?
    C. To Finish
    D. Other — Please Elaborate On This Choice Or Any Others.

20. What Is Your Most Reasonable Goal You Expect To Accomplish?

    A. A Specific Time — What Is That Time?
    B. A Specific Place — What Is That Place?
    C. To Finish
    D. Other — Please Elaborate On This Choice Or Any Others.

21. Have You Had Any Recent Injuries? If Yes, Please Describe.

TABLE K

Health and Performance Division
US Army Research Institute of Environmental Medicine
Natick, MA 01760-5007

ESQ Survey

INSTRUCTIONS: Write the number which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST HOUR. If you do not experience the symptom, write "1", NOT AT ALL.

NOT AT ALL	SLIGHT	SOMEWHAT	MODERATE	QUITE A BIT	EXTREMELY
1	2	3	4	5	6

1. I'M SHORT OF BREATH..... _____
2. IT'S HARD TO BREATHE..... _____
3. IT HURTS TO BREATHE..... _____
4. I HAVE MUSCLE CRAMPS..... _____
5. I HAVE STOMACH CRAMPS..... _____
6. MY MUSCLES FEEL TIGHT..... _____
7. I FEEL WEAK..... _____
8. MY LEGS OR FEET ACHE..... _____
9. MY HANDS, ARMS, OR SHOULDERS ACHE..... _____
10. MY BACK ACHES..... _____
11. I HAVE A STOMACH ACHE..... _____
12. I FEEL LIGHTHEADED..... _____
13. I HAVE A HEADACHE..... _____
14. I FEEL DIZZY..... _____
15. I FEEL FAINT..... _____
16. MY VISION IS DIM..... _____
17. MY COORDINATION IS OFF..... _____
18. I AM SICK TO THE STOMACH (NAUSEOUS)..... _____

NOT AT ALL	SLIGHT	SOMEWHAT	MODERATE	QUITE A BIT	EXTREMELY
1	2	3	4	5	6

19. I HAVE GAS PRESSURE..... _____

20. I FEEL WARM..... _____

21. MY FEET ARE SWEATY..... _____

22. I'M SWEATING ALL OVER..... _____

23. PARTS OF MY BODY ARE NUMB..... _____

24 MY EYES FEEL IRRITATED..... _____

25. MY NOSE FEELS STUFFED UP..... _____

26 I'VE BEEN HAVING NOSE BLEEDS..... _____

27. MY MOUTH IS DRY..... _____

28. I'VE LOST MY APPETITE..... _____

29. I FEEL SICK..... _____

30. I FEEL HUNGOVER..... _____

31. I'M THIRSTY..... _____

32. I FEEL TIRED..... _____

33. I FEEL SLEEPY..... _____

34. I COULDN'T SLEEP WELL..... _____

35. MY CONCENTRATION IS OFF..... _____

36. I FEEL IRRITABLE..... _____

37. I FEEL RESTLESS..... _____

38. I'M BORED..... _____

39. I FEEL DEPRESSED..... _____

40. I FEEL ALERT..... _____

41. I FEEL GOOD..... _____

TABLE L

Profile of Mood States Questionnaire

Below is a list of words that describe feelings people have. Please read each one carefully. Then fill in ONE space under the answer to the right which best describes HOW YOU HAVE BEEN FEELING DURING THE PAST FEW HOURS.

	not at all 0	a little 1	moder-ately 2	quite a bit 3	extremely 4
1. Friendly	[]	[]	[]	[]	[]
2. Tense	[]	[]	[]	[]	[]
3. Angry	[]	[]	[]	[]	[]
4. Worn Out	[]	[]	[]	[]	[]
5. Unhappy	[]	[]	[]	[]	[]
6. Clear-headed	[]	[]	[]	[]	[]
7. Lively	[]	[]	[]	[]	[]
8. Confused	[]	[]	[]	[]	[]
9. Sorry for things done	[]	[]	[]	[]	[]
10. Shaky	[]	[]	[]	[]	[]
11. Listless	[]	[]	[]	[]	[]
12. Peeved	[]	[]	[]	[]	[]
13. Considerate	[]	[]	[]	[]	[]
14. Sad	[]	[]	[]	[]	[]
15. Active	[]	[]	[]	[]	[]
16. On edge	[]	[]	[]	[]	[]
17. Grouchy	[]	[]	[]	[]	[]
18. Blue	[]	[]	[]	[]	[]
19. Energetic	[]	[]	[]	[]	[]
20. Panicky	[]	[]	[]	[]	[]
21. Hopeless	[]	[]	[]	[]	[]
22. Relaxed	[]	[]	[]	[]	[]
23. Unworthy	[]	[]	[]	[]	[]
24. Spiteful	[]	[]	[]	[]	[]
25. Sympathetic	[]	[]	[]	[]	[]
26. Uneasy	[]	[]	[]	[]	[]
27. Restless	[]	[]	[]	[]	[]
28. Unable to concentrate	[]	[]	[]	[]	[]
29. Fatigued	[]	[]	[]	[]	[]
30. Helpful	[]	[]	[]	[]	[]
31. Annoyed	[]	[]	[]	[]	[]
32. Discouraged	[]	[]	[]	[]	[]

	not at all 0	a little 1	moder-ately 2	quite a bit 3	extremely 4
33. Resentful	[]	[]	[]	[]	[]
34. Nervous	[]	[]	[]	[]	[]
35. Lonely	[]	[]	[]	[]	[]
36. Miserable	[]	[]	[]	[]	[]
37. Muddled	[]	[]	[]	[]	[]
38. Cheerful	[]	[]	[]	[]	[]
39. Bitter	[]	[]	[]	[]	[]
40. Exhausted	[]	[]	[]	[]	[]
41. Anxious	[]	[]	[]	[]	[]
42. Ready to fight	[]	[]	[]	[]	[]
43. Good Natured	[]	[]	[]	[]	[]
44. Gloomy	[]	[]	[]	[]	[]
45. Desparate	[]	[]	[]	[]	[]
46. Sluggish	[]	[]	[]	[]	[]
47. Rebellious	[]	[]	[]	[]	[]
48. Helpless	[]	[]	[]	[]	[]
49. Weary	[]	[]	[]	[]	[]
50. Bewildered	[]	[]	[]	[]	[]
51. Alert	[]	[]	[]	[]	[]
52. Deceived	[]	[]	[]	[]	[]
53. Furious	[]	[]	[]	[]	[]
54. Efficient	[]	[]	[]	[]	[]
55. Trusting	[]	[]	[]	[]	[]
56. Full of pep	[]	[]	[]	[]	[]
57. Bad-tempered	[]	[]	[]	[]	[]
58. Worthless	[]	[]	[]	[]	[]
59. Forgetful	[]	[]	[]	[]	[]
60. Carefree	[]	[]	[]	[]	[]
61. Terrified	[]	[]	[]	[]	[]
62. Guilty	[]	[]	[]	[]	[]
63. Vigorous	[]	[]	[]	[]	[]
64. Uncertain about things	[]	[]	[]	[]	[]
65. Bushed	[[]	[]	[]	[]	[]

TABLE M

Post-Race Coping Strategies

Directions: There are two sections to this questionnaire. The first section (I) are strategies used before the race took place to prepare for this race. The second section (II) are strategies used during this race. Please put a check under the tried column for each strategy that was tried and a check in the helped column if you feel it helped in today's race regardless of how successful your race turned out.

PRE-RACE SECTION

	STRATEGY	TRIED	HELPED
1.	Tried new training strategies for this particular race (e.g. added in hill training, longer runs, etc.).	----	----
2.	Did carbohydrate loading.	----	----
3.	Ran a simulated race or actual (training race) race to prepare for this race.	----	----
4.	Did non-physical running related activities prior to race to help motivation (e.g. progress charts, reading about others, attending running or athletic related conferences).	----	----
5.	Tried to relax, or used muscle relaxation techniques to reduce stress.	----	----
6.	Did meditation.	----	----
7.	Used positive mental imagery (e.g. finishing or winning the race).	----	----
8.	Used negative mental imagery (e.g. having to drop out of the race).	----	----
9.	Set multiple goals (including intermediate goals).	----	----
10.	Running for a cause other than just the race (e.g. dedicating the race to someone or something).	----	----
11.	Tapered for this race.	----	----
12.	Practice pre-race superstitions or rituals.	----	----
13.	Made a deal with yourself, giving yourself a special reward after the race.	----	----

II	DURING RACE STRATEGIES	TRIED	HELPED
1.	If you did set multiple goals, congratulated yourself after attaining an intermediated goal.	----	----
2.	Ran with others for portion of the race on purpose.	----	----
3.	Focused on body functions (HR, breathing, etc.)	----	----
4.	Focused on pain, trying to make it hurt more, to really feel the sensation.	----	----
5.	Tried to ignore the pain by focusing on other thoughts.	----	----
6.	Repeated a mantra.	----	----
7.	Always tried to keep a smile on one's face.	----	----
8.	Had friends and familiar faces stationed throughout the course.	----	----
9.	Thought of pleasant thoughts not related to the race.	----	----
10.	Sang songs to oneself.	----	----
11.	Focused on maintaining running form.	----	----
12.	Constantly adjusted race pace.	----	----
13.	Thought of God or other religious thoughts (e.g. prayers).	----	----
14.	Verbally self-talked to oneself (e.g. "your feeling good", "keep going").	----	----
15.	Considered dropping out of the race.	----	----
16.	Specific planned breaks for food and drink.	----	----

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